PHILOSOPHICAL TRANSACTIONS:

Giving ſome

ACCOUNT

OF THE

Preſent *Undertakings*, *Studies*, and *Labours*

OF THE

INGENIOUS,

In many

Conſiderable Parts of the WORLD.

VOL. XVIII. For the Year 1694.

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To the HONOURABLE
Sir *ROBERT SOUTHWELL*, Kt.
PRESIDENT;

And to the
Council and Fellows
OF THE
Royal Society
OF
LONDON,
FOR THE
Advancement of *Natural Knowledge*,
This Eighteenth Volume
OF THE
PHILOSOPHICAL TRANSACTIONS
Is humbly Dedicated

By *Richard Waller*, S.R.Secr.

IMPRIMATUR,

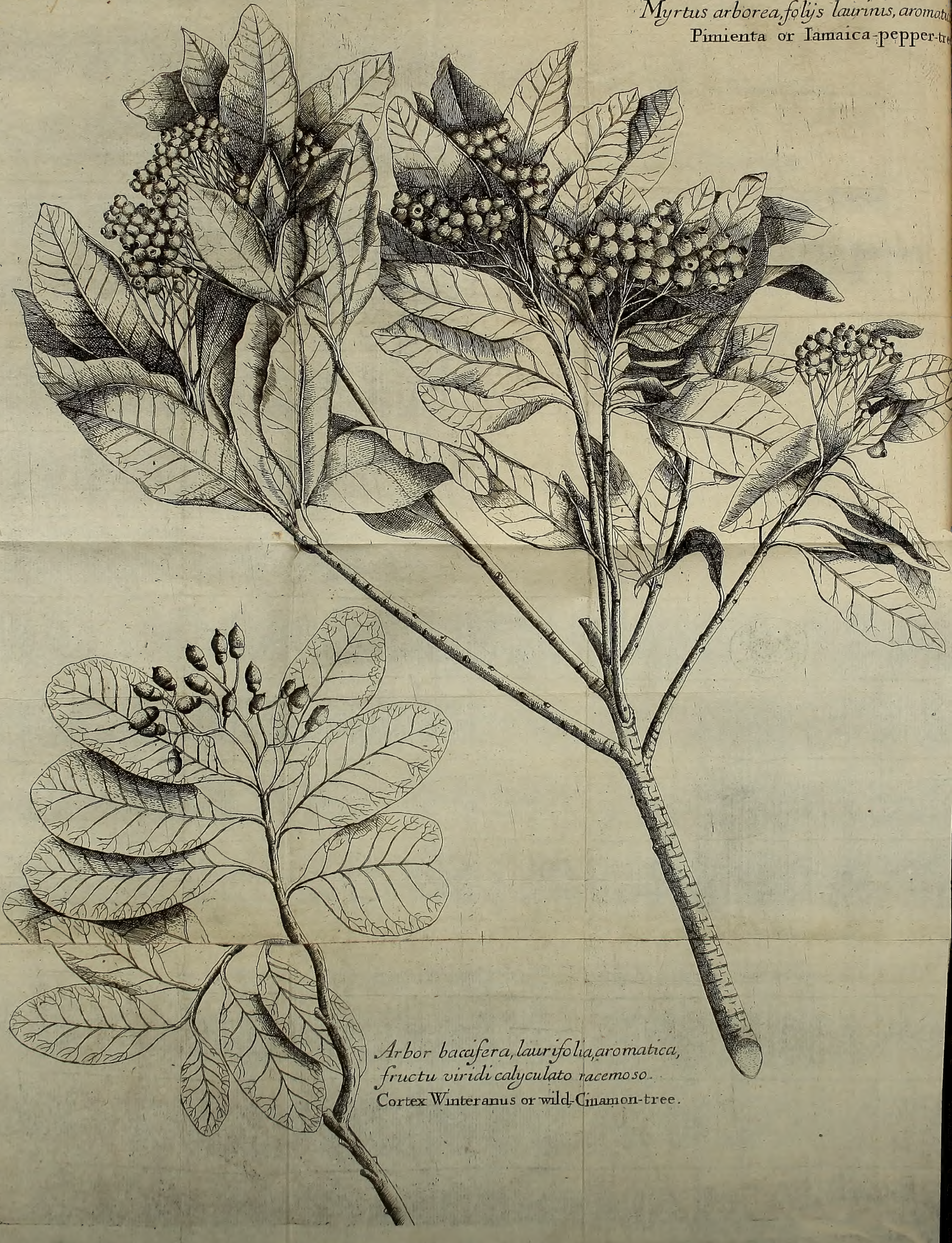
Vol. **XVIII.** Philoſoph. Tranſact.

Feb. 13. 169$\frac{4}{5}$.

Rob. Southwell,
P. R. S.

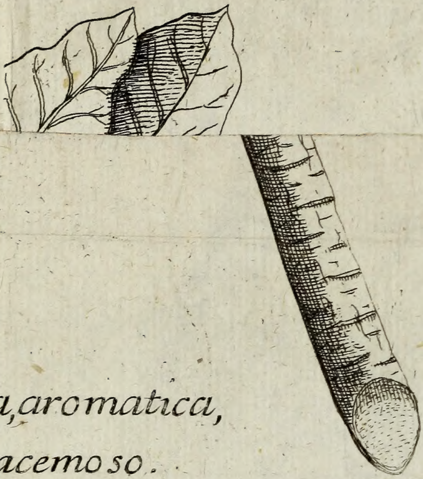
N. 192

Myrtus arborea, folijs laurinis, aromatic
Pimienta or Iamaica-pepper-tre



Arbor baccifera, laurifolia, aromatica,
fructu viridi calyculato racemoso.
Cortex Winteranus or wild-Cinamon-tree.

Myrtus arborea, folijs laurinis, aromat
Pimienta or Iamaica-pepper-tr



a, aromatica,
acemoso.
inamon-tree.

Num. 192

PHILOSOPHICAL TRANSACTIONS.

For the Months of *January* and *February*. 169$\frac{0}{1}$.

The CONTENTS.

1. A*N Advertiſement.* (2.) *An Account of an Obſervation of an Eclipſe of the Moon obſerved at* Moſcua *in* Ruſſia *on* April 5. ſt. v. 1688. *and compared with the ſame obſerved at* Lipſick, *whereby the Longitude of the former place is aſcertained. Together with the Latitudes of ſeveral principal Places in the Empire of* Ruſſia. (3.) *A Diſcourſe concerning the moſt ſeaſonable time of Felling Timber, written by the advice of the Honourable* Sam. Pepys *Eſq; Secretary of the Admiralty, and preſented to his late Majeſty. By* Rob. Plott LL. D. *and* R. S. *Soc.* (4.) *A Deſcription of the* Pimienta *or* Jamaica-Pepper Tree, *and of the Tree that bears the* Cortex Winteranus, *communicated by* Hans Sloane M. D. *and* Reg. *Soc. S.* (5.) *An account of the Circulation of the Watry Vapors of the Sea; and of the Cauſe of Springs: preſented to the R. Society, By* E. Halley. (6.) *A Diſcourſe concerning the Modern Theory of Generation, by Dr.* George Garden *of* Aberdeen; *being part of a Letter to Dr.* Will. Muſgrave LL. D. *and* R. S. *Soc. and by him communicated to the Royal Society.* (7.) Obſervatio Mercurii ſub ſole Viſi, ultimo Octobris. 1690. *ſt. vet.* habita Noribergæ ab Aſtronomo accuratiſſimo. *J. P. Wurtzelbaur,* atque ab eodem cum Regia Societate communicata. (8.) *An Account of*

an Experiment of the Injection of Mercury *into the Blood, and its ill effects on the Lungs: as it was communicated to the Royal Society, by their late worthy Member* A. Moulin, M.D. (9.) *An Account of a Book*; Medicina Hydroſtatica *or* Hydroſtaticks *applied to the* Materia Medica, *ſhewing how by the weight that divers Bodies uſed in Phyſick have in Water, one may diſcover whether they be Genuine or Adulterate; By the Honourable* ROBERT BOYLE, *Fellow of the Royal Society.* London. *Octavo.* 1690.

Advertiſement.

THE Publication of theſe Tranſactions having for ſome time paſt been ſuſpended, chiefly by reaſon that the unſetled poſture of Publick Affairs did divert the thoughts of the Curious towards Matters of more immediate Concern than are *Phyſical* and *Mathematical* Enquiries, ſuch as for the moſt part are the Subjects we treat of, with excluſion to many others wherewith the forein Journaliſt uſually ſupply their monthly Tracts: Theſe are now to Advertiſe, that for the future the *Royal Society* has commanded them to be Publiſhed as formerly, and if poſſibly Monthly. And all lovers of ſo good a Work are deſired to contribute their Diſcoveries in Art or Nature, addreſſing them as formerly to Mr. *H. Hunt* at *Greſham* College, and they ſhall be inſerted herein, according as the Authors ſhall direct.

An Account of an Obſervation of an Eclipſe of the Moon, obſerved at Moſcua *in* Ruſſia, *on* April 5. 1688. *compared with the ſame obſerved at* Lipſick; *whereby the Longitude of the former place is aſcertained: Together with the Latitude of ſeveral principal Places in the Empire of* Ruſſia.

THE Royal Society being deſirous to contribute what they may to the rectifying of Geography, and determining the Longitudes of Places, amongſt others did recommend the procuring an Eclipſe to be obſerved at *Moſcua*, to an eminent Merchant trading there; at whoſe inſtance one Mr. *Timmerman*, a Mathematician, reſiding on the place, returned the following account.

April 5. 1688. half a quarter of an hour after ſeven in the Evening, the Moon aroſe clear, but of a deep red colour without any ſign of Eclipſe: at 7h ½ the Moon went into a thick Cloud, but was again clear at 7h 38m when the under-ſide of the Body of the Moon was begun to be obſcured, in a clear Sky; ſhe being then in the 25th degree of *Libra*, and 6° ½ above the Horizon. *(Suppoſe the Center.)*

At 9h the whole under-ſide of the Moon was eclipſed, and about 8 minutes after nine, it was at the height, or rather ſeemed to decreaſe. At 9h ½ there was ſtill a third part of the Moon Eclipſed. *(Suppoſe of her Circumference.)*

About ten it decreaſed apace, and at 10h ½ there was but little to be ſeen: At 10h 45′ it was certainly ended, the Moon being then about 22° high. Thus far the Obſerver.

The duration of this Eclipſe is here made from 7h 38′ to about 10h 45′, which agrees within 8 or 10 minutes with our Tables, that never err ſenſibly in the continuance of Eclipſes; and ſo much ought to be allowed to an Obſerver not ſufficiently inſtructed to diſtinguiſh the *Penumbra* from the true ſhadow, though a ſmall Teleſcope were uſed in this Obſervation, as we are ſince informed. Let us conclude then, That the end was at $10^h\ 40'$ at *Moſcua.* We do not find that this Eclipſe was obſerved at *London*, and it was in probability cloudy, and otherwiſe only the latter part thereof would have been viſible: However this defect is in good part ſupplied by an Obſervation thereof made at *Lipſick*, by Mr. *Gottfrid Kirck*, and publiſhed in his *Ephemerides* for the Year 1689. where the end is determined at $8^h\ 54'$ P.M. Hence *Moſcua* will be $1^h\ 46'$ to the Eaſtwards of *Lipſick*; and the difference of Meridians between *London* and *Lipſick* being already determined 49 min. it will follow that *Moſcua* is $2^h\ 35'$ to the Eaſt of *London*, or $38°\ 45'$ of Longitude, which from other Accounts we find to be very near that of the City of *Aleppo* in *Syria.*

By the ſame Hand we have procured the Latitudes of the following Places, obſerved, as 'tis ſaid, with a large Quadrant.

	°	′
Moſcua	55	34
Yereſlaw	57	44
Wologda	59	19
Woſtak	61	15
Arkangel	64	30

A DISCOURSE *concerning the moſt ſeaſonable Time of Felling of Timber; Written by the advice of the Honorable* Sam. Pepys *Eſq; Secretary of the Admiralty, and preſented to his late Majeſty. By* Robert Plot *LL.D. and R. S. Soc.*

May it Pleaſe your MAJESTY,

WHEN I firſt imparted to your Majeſty the manner of felling of Timber in the County of *Stafford*, with the advantage it might give to your Royal Navy, were all the Timber uſed in building your Fleet ſo felled; according to your Majeſties command, I immediately (the ſame day) waited upon Mr. Secretary *Pepys* and Sir *Anthony Dean*, and communicated the Matter to them, who both promiſed me they would acquaint your Majeſty I had ſo done, and give your Majeſty an account of their preſent Thoughts of it: but the former, *viz.* Mr. Secretary *Pepys*, received ſo ſtrong an impreſſion of the uſefulneſs of the Experiment, and thought it (after conſideration) of that importance, that he deſired me, the day following, further to conſider this Subject, and ſee what might be added to what I had already written in my Hiſtory of *Staffordſhire* relating to it; and what material Obſervations made, why this Cuſtom of *Staffordſhire* and the Neighboring Counties, might not be practiſed here in the South of *England* as well as there; and ſo put all into Writing for your Majeſties uſe.

For the performance whereof, with as much brevity as perſpicuity will allow me, your Majeſty is firſt deſired to recollect what I told your Majeſty in *May* laſt, that the Cuſtom of felling Timber here in the South of *England*, differs from that of *Staffordſhire*, only in two things, *viz.* In the time of Felling, and manner of Barking. It being felled here in the Spring, as ſoon as the Sap is found to be fully up, by the Trees putting out, and then Bark'd after the Trees are proſtrate, the Sap yet remaining in the Bodies of them: Whereas there it is firſt barked, (in the Spring as here) but before it is felled, the Trees yet living and ſtanding all the Summer, and not felled till the following Winter, when the Sap is fully in repoſe: Whether of which Cuſtoms of felling Timber, either for Ships or other Buildings, is moſt eligible, is the Point to be diſcuſt.

In the clearing whereof, May it pleaſe your Majeſty firſt to take notice, that all Trees in the Spring Seaſon (when uſually we fell them in the South of *England*) and ſome time after, are pregnant, and ſpend themſelves (as Animals do in their reſpective Off-ſprings) in the production of Leaves and Fruits, and ſo become weaker than at other times of the Year; their Cavities and Pores being then turgid with Juices or Sap, which (the Trees being felled at that time) ſtill remain in the Pores, having now no manner of means of being otherwiſe ſpent, and there putrifie; Not only leaving the Tree full of theſe Cavities which render the Timber weak; But ſecondly breeding a Worm as both *Pliny* and Mr. *Evelyn* teſtifie, that will ſo exceedingly prejudice it, that it becomes altogether unfit for ſtrong Incumbencies, or other robuſt Uſes. Thirdly, That all Timber fell'd at this time of Year, whether the Juices putrifie, or otherwiſe ſweat forth, or dry away, is not only ſubject to rift and gape, but will ſhrink ſo conſiderably, that a Piece of ſuch Timber of a Foot ſquare will uſually ſhrink in the breadth $\frac{1}{4}$ of an Inch; than which, ſays *Vegetius*, nothing is more pernicious if uſed for the building of Ships. To which, Fourthly, The firſt and greateſt Roman Emperor *Julius Cæſar* adds, That tho Ships may be made of ſuch moiſt Timber fell'd in the Spring, yet they will certainly be Sluggs, not near ſo good Sailers as Ships made of Timber fell'd later in the Year.

In all which Circumſtances I find moſt of the Antients ſo very well agree, that none of them adviſe the felling of Timber for any ſort of uſe before Autumn at ſooneſt; others not till the Trees have born their Fruit, which ſays *Theophraſtus* muſt always be proportionably later, as their Fruits are ripe later in the Year: a third ſort not till Mid-winter: not till *November* ſays *Palladius*, nay, not till the Winter Solſtice, ſays the Wiſe *Cato*; and then too in the decreaſe or wane of the Moon, between the 15th and 23d day of her Age, ſays *Vegetius*, or rather according to *Collumella* between the 20th and the New Moon. In general ſays *Theophraſtus*, the Oak muſt be fell'd very late in the Winter, not till *December*, as the Emperor *Conſtantinus Pogonatus* poſitively aſſerts, the Moon too being then under the Earth, as 'tis for the moſt part in the day-time in the firſt part of its decreaſe. And the felling of Oak within thoſe Limits, they call *Tempeſtiva cæſura*, *Felling Timber in Seaſon*, which they all unanimouſly pronounce (if thus fell'd) will neither ſhrink, warp, nor cleave, nor admit of decay, in many years, it being as tough as Horn, and the whole Tree in a manner (as *Theophraſtus* aſſerts) as hard and firm as the Heart; with whom alſo agrees our Country-man Mr. *Evelyn*, if you fell not Oak (ſays he) till the Sap is in repoſe, as 'tis commonly about *November* and *December*, after the Froſt has well nipped them, the very Saplings thus cut, will continue without decay, as long as the Heart of the Tree.

And the reaſon of this is given in ſhort by *Vitruvius*, *quia aeris Hyberni vis comprimit & conſolidat arbores*, becauſe the Winter Air doth cloſe the Pores, and ſo conſequently conſolidates all Trees, by which means the Oak (as He and *Pliny* both expreſs it) will acquire a ſort of Eternity in its duration; and much more will it ſo, if it be barkt in the Spring, and left ſtanding all the Summer, expoſed to the Sun and Wind, as is uſual in *Staffordſhire*,

and

and the adjacent Counties, whereby they find by long Experience the Trunks of their Trees ſo dried and hardned, that the ſappy part in a manner becomes as firm and durable, as the Heart it ſelf.

Which way of barking and felling of Timber, tho it were unknown to the Antients (as perhaps it is to all the World beſides thoſe few Counties) yet they ſeem not unacquainted with the rationallity of the Practice: For *Seneca* obſerves the Timber moſt expoſed to the cold Winds, to be moſt ſtrong and ſolid, and that therefore *Chiron* made *Achilles*'s Spear of a Mountain Tree. *Homer* alſo tells us that the Spear of *Agamemnon* was ἀνεμοτρεφὲς ἔγχος, made of a Tree ſo expoſed, for which *Didymus* gives the reaſon τοῖς γὰρ ἀνέμοις (ſays he) πλεῖον γυμναζόμενα δένδρεα, στερεά, for that being continually Weather beaten, they become harder and tougher. And *Pliny* ſays expreſly as much for the Sun, as they for the Wind, *viz.* That the Wood of Trees expoſed to the Sun-ſhine, is the moſt faſt and durable, for which reaſon 'tis too that the Great *Vitruvius* prefers the Timber on the South ſide the *Appennine*, (where it winds about and incloſes *Tuſcany* and *Campania,* and ſtrongly reflects the conſtant Heats of the Sun upon it, as it were from a Concave;) incomparably before that, which grows upon the North ſide of the ſame Hill, in the ſhady moiſt Grounds: of which his opinion he renders us this reaſon, for that the Sun does not only lick up the ſuperfluous moiſtures of the Earth, whence the Trees are ſupplied in ſuch ſhady places with too great a quantity, but in great meaſure exhales the remaining Juices (after the production of Leaves and Fruits) out of the Trees themſelves, rendering the Timber of them the more cloſe, ſubſtantial and durable; which certainly it would do alſo much more effectually, if the Bark were taken of in the Spring of the Year, as is accuſtomed in *Staffordſhire*, where the

People are content to uſe this method in their proviſion of Timber, tho but for private Uſes.

Much rather ſhould it be done then in ſo publick a concern as the building of Ships, where tough and ſolid Timber is much more neceſſary than in ordinary Buildings. Nor can I yet meet with any material Objection, either from *Staffordſhire* Gentlemen (many of whom I have conſulted about this Affair ſince I informed your Majeſty of the advantage of it) or from any other, why this Practice may not be uſed here in the South of *England*, as well as there. There is indeed an Act of Parliament 1 *Jac.* 1. *chap.* 22. whereby your Majeſties Subjects are forbid felling Timber for ordinary Uſes (in conſideration of the Tan) at any other time but between the firſt of *April* and laſt of *June*, when the Sap is up and the Bark will run, made on ſuppoſition (I gueſs) that ſhould they have admitted felling Timber in any other Seaſon, the Tanners would have wanted a ſupply of Bark. To which I readily anſwer, That I fear the Legiſlators that preſs'd the making that Act, were ignorant that the Bark might be taken off in the Spring, and that the Tree notwithſtanding would live and flouriſh till the Winter following, as I have ſeen many in *Staffordſhire*: So that tho the Tree be not fell'd till the Winter Solſtice, or *January* following, yet the Tanner is not at all defeated of his Tan, but has it here in as due Seaſon as in any of the Southern Counties. The Legiſlators I ſay were ignorant of this, otherways they would never have made an Act ſo pernicious to the whole Kingdom, as felling Timber at this Seaſon is, for the ſake of a few Tanners.

But notwithſtanding this ignorance, yet then they were ſo wiſe as to except in that Act the Timber to be uſed in building of Ships, which may be fell'd in Winter, or any other time; as I am told all the ancient Timber remaining in the *Royal Sovereign* was, it being ſtill ſo hard that 'tis no eaſie matter to drive a Nail into it, ſo that your Majeſty has no need of giving your ſelf the trouble of procuring the alteration or repeal of that Act, upon this account only, tho it may poſſibly be deſirable (becauſe profitable to the Subject) upon many others.

'Tis true indeed that the barking or peeling the Tree ſtanding, is ſomewhat more troubleſome, and therefore ſomewhat more chargeable, than when they are proſtrate; and that 'tis likely People therefore have uſually fell'd their Timber, as well for Shipping as other uſes, in the Spring of the Year, for the ſake of the more eaſie and cheap barking it only, than any thing elſe. 'Tis true too, that Timber is harder to fell in Winter, it being now ſo compact and firm, that the Ax will not make ſo great imperſſion, as it doth in the Spring, which will alſo encreaſe the price of the felling ſome ſmall matter, and its ſawing afterwards; but how inconſiderable theſe things are in compariſon of the great good your Majeſty will reap by this manner of felling, (as is plain from what has been ſaid above,) I need not acquaint your Majeſty, it being (I think) ſelf evident.

The greateſt Objection, that I can foreſee will be urged here in the South againſt this practice, is, That if the Timber be not fell'd till Mid-winter or *January*, where it grows in Copſes and Woods, they cannot perhaps incloſe their young Springs ſo ſoon as ſome may imagine needful, and therefore will be backward to fell their Timber (ſo growing) at that Seaſon.

To which I anſwer, Firſt, That the Timber ſo fell'd in the Wood or Copſes may be eaſily carried off before the ſecond Spring, and ſo the prejudice ſmall, and the firſt it muſt be there where ever it is fell'd: but ſecondly, that which will quite remove this inconſiderable difficulty, is, That perhaps your Majeſty may think it expedient, that no Timber whatſoever growing in Woods or Copſes be at all bought into your Majeſties Yards, for that Timber growing in ſuch ſhady places, and ſo fenced from Sun and Wind, as Timber in Woods for the moſt part is, cannot be ſo good as that which comes from an expoſed ſituation, ſuch as it uſually has in your Majeſties Foreſts, and in the Parks and Hedge-rows or open Fields of your Subjects, where too it is indifferent at leaſt, if not better for the Proprietor, that it be fell'd in Winter (when the Graſs and Corn is gone) than in the Spring it ſelf: So that I cannot ſee what your Majeſty has more to do in this Matter, in caſe your Majeſty think fit to make uſe of this Method, than to order your Officers aſſigned for that purpoſe to buy all their Timber under ſuch Conditions as to be fell'd in Winter; enjoyning the Proprietor (unleſs your Majeſty think fit to buy the Bark) to take it off in the Spring in due time, making him ſome ſmall allowance for the trouble he will have in peeling it ſtanding.

Which is all I have met with further at preſent to inform your Majeſty of, concerning this matter, wherein, if it ſhould ſo happily fall out, that I have done your Majeſty any the leaſt Service, the internal Satisfaction I ſhall conceive from it, together with your Majeſties favourable Acceptance, will be an ample Reward to

Your Majeſties, &c.

A Deſcription of the Pimienta *or* Jamaica *Pepper-Tree, and of the Tree that bears the* Cortex Winteranus: *Communicated by* Hans Sloane, *M. D. and* Reg. Soc. S.

Myrtus arborea foliis laurinis aromatica: ſive Pimienta, Jamaica-Pepper, *or All-Spice-Tree.*

THis Tree has a Trunk as thick as ones thigh, riſing ſtreight about 30 feet high, covered with an extreamly polite or ſmooth Skin of a gray colour, and branched out on every hand, having the ends of its Twigs ſet with Leaves of ſeveral ſizes, the largeſt being 4 or 5 inches long, and 2 or 3 broad in the middle where broadeſt, and whence it decreaſes to both extreams ending in a point, ſmooth, thin, ſhining, without any inciſures, of a deep green colour, and ſtanding on inch-long footſtalks; when bruis'd very odoriferous, and in all things like the Leaves of a Bay-tree. The ends of the Twigs are branch'd into bunches of Flowers, each footſtalk ſuſtaining a Flower made up of four herbaceous or pale-green *Petala* bowed back or reflected downwards, within which are many *Stamina* of the ſame colour. To theſe follows a bunch of crowned or umbilicated Berries (the Crown being made up of four ſmall *Foliola* or Leaves) which are bigger when ripe than Juniper-berries, at firſt when ſmall, greeniſh; but when ripe, they are black, ſmooth and ſhining, containing in a moiſt, green, aromatick and biting Pulp two large *Acini* or Seeds, ſeparated by a Membrane lying between them, each whereof is a Hemiſphere, and both join'd make a Globe or Spherical (appearingly one) *Acinus*, whence *Cluſius* makes it one Seed diviſible into two parts.

It grows on all the hilly parts of the Iſland of *Jamaica*, but chiefly in the North-ſide thereof; and where-ever theſe Trees grow, they are generally left ſtanding when other Trees are fell'd, or they are ſometimes planted where they never grew, becauſe of the great profit from the cur'd Fruit ſent in great quantities yearly into *Europe*.

It flowers in *June*, *July* and *Auguſt*, but in ſeveral places ſooner or later, according to their ſituation and different Seaſon for Rains: and after it flowers the Fruit ſoon ripens; but 'tis to be obſerv'd, that in clear'd open Grounds, 'tis ſooner ripe than in thicker Woods.

There is no great difficulty in the curing or preſerving of this Fruit for uſe, 'tis for the moſt part done by the *Negro's*; they climb the Trees, and pull off the Twigs with the unripe green Fruit, and afterwards carefully ſeparate the Fruit from the Twigs, Leaves, and ripe Berries; which done, they expoſe them to the Sun from its riſing to ſetting for many days, ſpreading them thin on cloaths, turning them now and then, and carefully avoiding the dews (which are there very great.) By this means they become a little wrinkled or rugous, dry, and from a green change to a brown colour, and then they are fit for the Market, being of different ſizes, but generally of the bigneſs of black Pepper, ſomething like in ſmell and taſte to Cloves, Juniper-berries, Cinamon, and Pepper, or rather having a peculiar mixt ſmell, ſomewhat akin to them all, whence the name of *All-Spice*. The ripe Berries are very carefully ſeparated from thoſe to be cured, becauſe their wet and plenteous Pulp renders them unfit for Cure. Whence theſe Berries always coming unripe dryed into *Europe*, has been the occaſion of Naturaliſts thinking it to be *fructu umbilicato ſicco*. The more fragrant and ſmaller they are, they are counted the better.

This Fruit with water diſtilled *per Veſicam*, yields a very odoriferous Chymical Oyl ſinking to the bottom of water like Oyl of Cloves. It may deſervedly be counted the beſt and moſt temperate, mild and innocent of common Spices, and fit to come into greater uſe, and to gain more ground than yet it hath of the *Eaſt-India* Commodities of this kind, almoſt all of which it far ſurpaſſes by promoting the digeſtion of Meat, attenuating tough Humours, moderately heating, ſtrengthening the Stomach, expelling Wind, doing thoſe friendly offices to the Bowels we generally expect from Spices.

It is now commonly ſold by Druggiſts for *Carpobalſamum*, which I ſuppoſe came from *Hernandez*, who ſays it may be its *ſuccedaneum*; but it is not that Fruit, but ſeems more fragrant and leſs adſtringent and balſamick. *Cluſius* ſays, that it takes away, if chew'd, a ſtinking Breath. *John de Barrios* tells us, 'tis one of the Ingredients of Chocolate in *New Spain*, and *Franciſcus Uria*, who brought it from *New Spain* and gave it to *Redi*, ſaid it was there commended againſt the Epilepſie and *Gutta ſerena*, which he in divers perſons tryed, but without ſucceſs; but he at the ſame time ſays, he thinks it a good Stomachic and Cephalick Medicine moderately given, *Exper. Nat. pag.* 132.

It has been taken by *Cluſius* for *Pliny*'s *Garyophyllon*, and by others for *Amomum*: But 'tis not likely that it was known to the Ancients, not being known to grow in the *Eaſt*, but *Weſt-Indies*, whence it was brought into *England*, and ſent to *Cluſius*, who firſt deſcribed and figured it, giving it this name *Amomum quorundam*, An *Caryophyllon Plinii*, *Exot. p.* 17. from whence came that in *Gerard*, *Amomum quorundam, forte Caryophyllon Plinii*, *p.* 1610. and that of *Parkinſon*, *Amomum aliud quorundam, & Garyophyllon Plinii à Cluſio ſuſpicatum*, *p.* 1567. likewiſe that of *Caryophyllus aromaticus fructu rotundo*, *C. B. p.* 411. & *Amomum quorundam odore Caryophylli*, *J. B. Tom.* 2. *p.* 194. *Redi* in his *Exper. Nat. p.* 132. ſpeaks of this, and figures it under the name of *Piper Chiapæ*. And Dr. *Trapham* in his Diſcourſe of the

State of Health in the Iſland of *Jamaica*, calls it the Bay-tree or Spicy Piemento, *p.* 38. And Dr. *Grew* in his *Muſæum Regalis Societatis* calls theſe, being very large, Aromatick Indian Berries, or *Cocculi Indi aromatici, p.* 211.

It is alſo very likely that *Hernandez* does deſcribe this under the name of *Xocoxitl, ſeu Piper Tavaſci, p.* 30. his Deſcription agreeing in every thing only the Flower, which muſt, if he rightly deſcribes it, make it different; for he makes it to have a Scarlet Flower like to the Pomegranate, ſmelling like Orange-flowers, no way agreeing to this. And *Ximenes* in the Spaniſh Hiſtory of *Hernandez* printed at *Mexico*, deſcribes it the ſame way by the name of *Xocoxitl o Pimienta de Tavaſco, fol.* 2. ſo that I remain in doubt, but am apt to believe it the ſame, only ill deſcribed by this Author.

I am likewiſe, on account of an ill deſcription, very much at a loſs to know whether this be the Tree *Piſo* deſcribes in the firſt Edition of his Book, *p.* 98. 1648. under the name of *Anhuiba miri.*

Arbor Baccifera, laurifolia, aromatica, Fructu viridi calyculato ramoſo.

Wild Cinamon-tree, commonly but falſly called Cortex Winteranus.

THis Tree has a Trunk about the thickneſs of ones Thigh, riſing to about 20 or 30 foot high, having many Branches and Twigs hanging downwards, making a very comely Top. The Bark conſiſts of two parts, one outward, and another inward. The outward Bark is thin as a mill'd Shilling, of a whitiſh Aſh or gray colour, with ſome whiter ſpots here and there on it, and ſeveral ſhallow Furrows of a darker colour, running variouſly through it making it rough, of an aromatick taſte. The inward Bark is much thicker than Cinamon, being as thick as a mill'd Crown-piece, ſmooth, of a whiter colour than the outward, of a much more biting and aromatick taſte ſomething like that of Cloves, and not glutinous like Cinamon, but dry and crumbling between the teeth. The Leaves come out near the ends of the Twigs without any order ſtanding on inch-long foot-ſtalks, they are each of them two inches long, and one inch broad near the end where broadeſt, and roundiſh, being narrow at beginning, from whence it augments in breadth to near its end, of a yellowiſh green colour, ſhining and ſmooth, without any inciſures about its edges, and ſomewhat reſembling the Leaves of Bay or *Lauroceraſus*. The ends of the Twigs are branched into bunches of Flowers, ſtanding ſomething like Umbels, each of which has a foot-ſtalk, on the top of which is a *Calix* made up of ſome *Foliola*, in which ſtand five Scarlet or Purple *Petala*, within which is a large *Stylus*. To theſe follow ſo many *calyculated* Berries of the bigneſs of a large Pea, roundiſh, green, and containing, within a mucilaginous pale-green thin Pulp, four black ſhining Seeds or *Acini*, of an irregular figure.

All the parts of this Tree, when freſh, are very hot, aromatick, and biting to the taſte, ſomething like Cloves, which is ſo troubleſom as ſometimes to need a remedy from fair water.

It grows in the Low-land or *Savanna* Woods very frequently, on each ſide of the Road between *Paſſage-Fort* and the Town of St. *Jago de la Vega* in *Jamaica*, in *Antigua*, and other the *Caribbe* Iſlands.

The Bark of this Tree is what is chiefly in uſe, both in the Plantations of the Engliſh between the Tropicks in the *Weſt-Indies*, and in *Europe*, and is without any difficulty cured by only cutting off the Bark, and letting it dry in the ſhade.

It is in uſe in the *Weſt-Indies* by the more ordinary ſort of People in place of all other Spices, being thought very good to conſume the immoderate humidities of the Stomack, help Digeſtion, expel Wind, *&c.*

It is likewiſe as well there as in *Europe* thought a very good Remedy againſt the Scurvy, and to cleanſe and envigorate the Blood, being in *London*-Druggiſts and Apothecaries Shops uſed for thoſe purpoſes, under the name of *Cortex Winteranus*, which it is not, that being different (as may appear from the Deſcriptions) but may very well ſupply its place: it is in the *Weſt-Indies* mixed and given with Steel, and other Medicines; but if the Patient be any way of a hot Conſtitution, it does more harm than good, being very warm.

Rum, a vinous Spirit drawn from Moloſſus or bad Sugar fermented with Water, if it be mixed with ſome of this Bark, loſes in part its loathſome empyreumatick Smell.

This Bark if mixed with Water, and deſtilled *per Viſicam*, yields an aromatick Oil ſinking to the bottom of Water like Oil of Cloves, with ſome ſmall quantity of which it being mixed has ſometimes been ſold for true Oil of Cloves.

The firſt Author I find to mention this was *Peter Martyr* in *Decad. Ocean*, under the name of *Cortex Cinamómi ſaporem, Gingiberis amaritudinem & Caryophylli ſuavem odorem præ ſe ferens. Nicolaus Monardes* was the next, who deſcribes this under the name of *Lignum Aromaticum*, from whom the *Hiſt. Ludg.* took the ſame, and *Cluſius* in his Comment on this Author corrects him, giving it the name of *Lignum ſeu potius Cortex Aromaticus, Exot. p.* 324. & *Johannes Bauhinus. Lignum Aromaticum ſeu potius Cortex Monard. Hiſt. pl. tom.* 1. *p.* 460.

By the Deſcription, *&c.* of another Bark, in Authors under the name of White Cinamon I queſtion not, it is the ſame with this, every thing agreeing.

This is therefore

Canella alba quorundam. Cluſ. Exot. p. 324. *I. B. p.* 461.
Canella alba Park. p. 1581.
Canella alba ex arbore, Ejuſdem ibid.
Cinamomum ſive Canella tubis minoribus alba. C. B p. 409.

It is likewiſe what *Linſchoten* in his Deſcription of *America*, tranſlated into French gives an account of, as I ſuppoſe from *Peter Martyr*, under the name of *Arbre ou les Pigeons nichent*; and what Dr. *Trapham* in his Diſcourſe of the State of Health of *Jamaica*, calls *Winter-Bark*, or *Weſt-Indian* Cinamon Tree, p. 38. *Hernandez*, *p.* 43. and *Ximenes* who publiſh'd his Hiſtory at *Mexico* in Spaniſh, fol. 9. likewiſe deſcribe this under the name of *Caninga.*

It may be doubted whether this be *Aſcopo* of *Hariot*, which he mentions p. 24. of his Latin Edition of his Voyage by *Theodore de Bry*, and by *Hakluyt* in his Collection of Voyage, *p.* 275. of *Vol.* III.

Thus far this moſt excellent Botaniſt; *who was likewiſe pleaſed to communicate the elegant Figures of theſe Plants hereto annexed, by which the Reader may ſee what may be hoped in Natural Hiſtory from ſo Curious a Hand.*

An Account of the Circulation of the watry Vapours of the Sea, and of the Cauſe of Springs, preſented to the Royal Society. By E. Halley.

SOME time ſince, I ſhewed an Experiment of the Quantity of Water raiſed in Vapour from the ſurface of the Sea in a days time, which was ſo far approved by ſome honourable Members of this Society, that I have received their Commands to proſecute thoſe Enquiries, and particularly in relation to the Method uſed by Nature to return the ſaid Vapours again into the Sea, which is ſo juſtly performed that in many hundreds of years we are ſufficiently aſſured that the Sea has not ſenſibly de creas'd by the loſs in Vapour; nor yet abounded by the immenſe quantity of freſh it receives continually from the Rivers. To demonſtrate this Equilibre of receipt and Expence in the whole Sea is a Task too hard for me to undertake, yet in obedience to thoſe whom I have the honour to ſerve, I ſhall here offer, what to me has hitherto ſeemed the moſt ſatisfactory Account of this Grand *Phænomenon:* I have formerly attempted to explain the manner of the riſing of Vapour by warmth, by ſhewing that if an Atom of Water were expanded into a Shell or Bubble ſo as to be ten times as big in Diameter as when it was Water, ſuch an Atom would become ſpecifically lighter than Air, and riſe ſo long as *that Flatus* or warm Spirit that firſt ſeparated it from the maſs of Water ſhall continue to diſtend it to the ſame degree; and that warmth declining, and the Air growing cooler and withal ſpecifically lighter, the Vapours conſequently ſhall ſtop at a certain Region of the Air, or elſe deſcend, which may happen upon ſeveral Accounts as I ſhall by and by endea-deavour to make out. Yet I undertake not that, this is the only principal of the riſe of Vapours, and that there may not be a certain ſort of matter whoſe *conatus* may be contrary to that of Gravity: as is evident in Vegetation wherein the tendency of the ſprouts is directly upwards or againſt the Perpendicular. But whatever is the true cauſe, it is in fact certain, that warmth does ſeperate the particles of Water and emit them with a greater and greater Velocity as the heat is more and more intenſe, as is evident in the ſteam of a boyling Cauldron, wherein likewiſe the Velocity of the Aſcent of the Vapours does viſibly decreaſe till they diſappear, being diſperſed into and aſſimulated with the Ambient Air. Vapours being thus raiſed by warmth, let us for a firſt ſuppoſition put, that the whole ſurface of the Globe were all Water very deep, or rather that the whole Body of the Earth were Water, and that the Sun had his Diurnal courſe about it: I take it, that it would follow that the Air of it ſelf would imbibe a certain quantity of Aqueous Vapours, and retain them like Salts diſſolved in Water; that the Sun warming the Air and raiſing a more plentiful Vapour from the Water in the day time, the Air would ſuſtain a greater proportion of Vapour, as warm Water will hold more diſſolved Salts, which upon the abſence of the Sun in the Nights would be all again diſcharged in Dews, Analogous to the precipitation of Salts on the cooling of the Liquors; nor is it to be believed that in ſuch caſe there would be any diverſity of Weather, other than periodically, every year alike; the mixture of all Terreſtrious, Saline, Heterogeneous Vapours being taken away: which as they are variouſly compounded and brought by the Winds ſeem to be the cauſes of thoſe various Seaſons which we now find. In this caſe the Airy regions every where at the ſame height would be equally repleniſhed with the proportion of Water it could contain, regard being only to be had to the different degree of warmth, from the nearneſs or diſtance of the Sun; and an Eternal Eaſt Wind would blow all round the Globe, inclining only to the ſame ſide of the *Eaſt*, as the Latitude doth from the Equator; as is obſerved in the Ocean between the Tropicks.

Next, Let us ſuppoſe this Ocean interſperſed with wide and ſpacious Tracts of Land, with high ridges of Mountains ſuch as the *Pyrenean*, the *Alps*, the *Apennine*, the *Carpathian* in *Europe*; *Taurus*, *Caucaſus*, *Imaus* and ſeveral others in *Aſia*; *Atlas* and the *Montes Lunæ*, with other unknown Ridges in *Africa*, whence came the *Nile*, the *Nigre*, and the *Zaire*. And in *America* the *Andes*, and the *Apalatean* Mountains: each of which far ſurpaſs the uſual height to which the Aqueous Vapours of themſelves aſcend, and on the tops of which the Air is ſo cold and rarified as to retain but a ſmall part of thoſe Vapours that ſhall be brought thither by the Winds. Thoſe Vapours therefore that are raiſed copiouſly in the Sea, and by the Winds are carried over the low Land to thoſe Ridges of Mountains, are there compelled by the ſtream of the Air to mount up with it to the tops of the Mountains, where the Water preſently precipitates, gleeting down by the Crannies of the ſtone; and part of the Vapour entring into the Caverns of the Hills, the Water thereof gathers as in an Alembick into the Baſons of ſtone it finds, which being once filled, all the overplus of Water that comes thither runs over by the loweſt place, and breaking out by the ſides of the Hills, forms ſingle *Springs.* Many of theſe running down by the Valleys or Gutts between the ridges of the Hills, and coming to unite form little Rivulets or Brooks: Many of theſe again meeting in one common Valley and gaining the plain Ground, being grown leſs rapid become a River: and many of theſe being united in one common Channel make ſuch ſtreams as the *Rhine*, the *Rhone*, the *Danube*, which latter one would hardly think the collection of Water condenſed out of Vapour, unleſs we conſider how vaſt a Tract of Ground that River drains, and that it is the ſum of all thoſe Springs which break out on the South ſide of the *Carpathian* Mountains, and on the North ſide of the immenſe Ridg of the *Alps*, which is one continued Chain of Mountains from *Switzerland* to the *Black Sea.* And it may almoſt paſs for a Rule, that the Magnitude of a River, or the Quantity of Water it Evacuates is proportionable to the length and height of the Ridges from whence its Fountains ariſe. Now this Theory of *Springs* is not a bare *Hypotheſis* but founded on Experience, which it was my luck to gain in my abode at Saint *Helena*, where in the Night time, on the tops of the Hills about 800 yards above the Sea, there was ſo ſtrange a condenſation, or rather precipitation of the Vapours, that it was a great Impediment to my Celeſtial Obſervations;

for in the clear Sky the Dew would fall ſo faſt as to cover, each half quarter of an hour, my Glaſſes with little drops, ſo that I was neceſſitated to wipe them ſo often, and my Paper on which I wrote my Obſervations would immediatly be ſo wet with the Dew, that it would not bear Ink: by which it may be ſuppoſed how faſt the Water gathers in thoſe mighty high Ridges I but now named.

Thus is one part of the Vapours blown upon the Land returned by the Rivers into the Sea, from whence they came; another part by the cool of the Night falls in Dews, or elſe in Rains, again into the Sea before it reaches the Land, which is by much the greateſt part of the whole Vapour, becauſe of the great extent of the Ocean, which the motion of the Winds does not traverſe in a very long ſpace of time. And this is the reaſon why the Rivers do not return ſo much into the *Mediterranean* as is extracted in Vapour. A third part falls on the lower Lands, and is the *Pabulum* of Plants, where yet it does not reſt, but is again exhaled in Vapour by the Action of the Sun, and is either carried by the Winds to the Sea to fall in Rain or Dew there, or elſe to the Mountains to be there turned into Springs; and though this does not immediately come to paſs, yet after ſeveral viciſſitudes of riſing in Vapour and falling in Rain or Dews, each particle of the Water is at length returned to the Sea from whence it came. Add to this that the Rain-waters, after the Earth is fully ſated with moiſture, does by the Valleys or lower parts of the Earth find its way into the Rivers, and ſo is compendiouſly ſent back to the Sea. After this manner is the Circulation performed, and I doubt not but this Hypotheſis is more reaſonable than that of thoſe who derive all Springs from the Rain-waters, which yet are perpetual and without diminution, even when no Rain falls for a long ſpace of time: Or than that that derives them from a Filtration or Percolation of the Sea-waters through certain imaginary Tubes or paſſages within in the Earth, wherein they loſe their ſaltneſs. This beſides many others labouring under this principal Abſurdity, that the greateſt Rivers have their moſt copious Fountains fartheſt from the Sea, and whither ſo great Quantities of freſh Water cannot reaſonably be derived any other way than in Vapour. This, if we may allow final Cauſes, ſeems to be the deſign of the Hills, that their Ridges being placed through the midſt of the Continents, might ſerve as it were for Alembicks to diſtil freſh Water for the uſe of Man and Beaſt, and their heights to give a deſcent to thoſe Streams to run gently, like ſo many Veins of the *Macrocoſm*, to be the more beneficial to the Creation. If the difference between Rain and Dew, and the cauſe why ſometimes 'tis Cloudy, at other times Serene, be enquired, I can offer nothing like a proper ſolution thereof, only with ſubmiſſion to propoſe Conjectures which are the beſt I can find, *viz.* That the Air being heap'd up by the meeting of two contrary Winds, when the Mercury is high, the Vapours are the better ſuſtained and kept from Coagulating or condenſing into Drops, whereby Clouds are not ſo eaſily generated: and in the Night the Vapouts fall down ſingle as they aroſe in imperceptible Atoms of Water. Whereas when the Mercury is low and the Air rarified by the exhauſtion thereof, by two contrary Winds blowing from the place; the Atoms of Air keep the Vapours not ſo well ſeparated, and they coaleſce into viſible drops in the Clouds; and from thence are eaſily drawn into greater drops of Rain. To which 'tis poſſible and not improbable, that ſome ſort of Saline or Angular particles of Terreſtrial Vapour being immixt with the Aqueous, which I take to be Bubbles, may cut or break their Skins or Coats, and ſo contribute to their more ſpeedy Condenſation into Rain.

A Diſcourſe concerning the Modern Theory *of* Generation, *by Dr.* George Garden *of* Aberdeen, *being part of a Letter to Dr.* William Muſgrave, *L L. D. Reg. Soc. S. and by him communicated to the Royal Society.*

THE Subject I pitch upon, is that of the formation of Animals. You know how wide and unſatisfying Mens Conjectures were upon this Head until this Age, in which firſt the deſervedly Famons Dr. *Harvey* diſcovered the proper place of the formation of the Chick in the *Cicatricula* of the Egg, and the formation of the Parts ſo far as was diſcernable by the naked Eye; and after him *Malpighius* by the help of exact Glaſſes, obſerved the firſt Rudiments of it there, both before and after Incubation: And *R. de Graef* and others, having upon many Obſervations concluded that the *Teſtes Fœminei* were the Ovaries of Females, and conſequently that all Animals were *ex ovo*; they began from hence to infer, that the Rudiments of each Animal were originally in the reſpective Females, and that the Male contributed only to give a new Ferment to the Maſs of the Blood and Spirits, by which means a ſpirituous Liquor (which the Blood in its ordinary Ferment could not produce) did inſinuate its ſelf into the ſame Ducts and Pores of the Rudiments of thoſe Animals which were in greateſt forwardneſs in the Ovary, and ſo extend, and enlarge all their Parts, and at laſt bring them to perfection, as Mr. *Perrault* does ingeniouſly diſcourſe in the third Part of his *Eſſais de Phyſique*; till now at laſt *Leewenhoeck* has diſcovered an infinite number of *Animalcula in ſemine marium* of all Kinds, which has made him condemn the former Opinions about the propagation of all Animals *ex Ovo*.

Now upon comparing the Obſervations and Diſcoveries which have been made with one another; theſe three things ſeem to me very probable. 1. That Animals are *ex Animalculo.* 2. That theſe Animalcles are originally *in ſemine Marium & non in Fœminis.* 3. That they can never come forward, nor be formed into Animals of the reſpective kind, without the *Ova in fœminis.*

The firſt of theſe ſeems probable from theſe three Obſervations. 1. That ſome ſuch thing has been ſo often obſerved by *Malpighius* in the *Cicatricula* of an Egg before Incubation, as the Rudiments of an Animal in the ſhape of a Tadpole, as may be ſeen in his firſt, and in his repeated Obſervations *de formatione Pulli in Ovo.* 2. The ſudden appearance and diſplaying of all the parts after Incubation makes it probable, that they are not then actually formed out of a Fluid, but that the *Stamina* of them have been formerly there exiſtent, and are now expanded. The firſt part of the Chick which is diſcovered with] the naked Eye is, you know, the *Punctum ſaliens*, and that not till three days and nights of Incubation be paſt, and then on the fifth day the Rudiments of the Head and Body do appear. This made Dr. *Harvey* conclude that the Blood had a being before any other part of the Body, and that from it all the Organs of the *Fœtus* were both form'd, and nouriſhed; but by *Malpighius*'s Obſervations we find that the parts are then only ſo far extended as to be made viſible to the naked Eye, and that they were actually exiſtent before, and diſcernable by Glaſſes. After an Incubation of thirty hours are to be ſeen the Head, the Eyes, and the *Carina*, with the *Vertebræ*, diſtinct, and the Heart. After forty hours its Pulſe is viſible, and all the other parts more diſtinct, which cannot be diſcerned by the naked Eye before the beginning of the fifth day; from whence it ſeems very probable, that even the ſo early diſcovery of thoſe parts of the *Fœtus* by the Microſcope, is not the diſcerning of parts newly form'd, but only more dilated and extended by receiving of Nutriment from the *Colliquamentum*; ſo that they ſeem all to have been actually exiſtent before the Incubation of the Hen. And what *Swammerdam* has diſcovered in the transformation of Inſects, gives no ſmall light to this, whilſt he makes appear in the Explanation of the 13th Table ofthe General Hiſtory of Inſects,that in thoſe large *Eruca*'s which feed upon Cabbage, if they be taken about the time they retire to be transform'd into *Aurelia*'s, and plung'd often in warm Water to make a Rupture of the outer Skin, you will diſcern thro the tranſparency of their ſecond Membrane, all the parts of the Butterfly, the Trunk, Wings, Feelers, *&c.* folded up. But that after the *Eruca* is chang'd into an *Aurelia*, none of theſe parts can be diſcerned, they are ſo drencht with moiſture, tho they be there actually form'd. Another Conſideration is from the Analogy, which we may ſuppoſe between Plants and Animals. All Vegetables we ſee do proceed *ex Plantula*, the Seeds of Vegetables being nothing elſe but little Plants of the ſame kind folded up in Coats and Membranes: and from hence we may probably conjecture that ſo curiouſly an organized Creature as an Animal, is not the ſudden product of a Fluid or *Colliquamentum*, but does much rather proceed from an Animalcle of the ſame kind, and has all its little Members folded up according to their ſeveral Joynts and Plicatures, which are afterwards enlarged and diſtended, as we ſee in Plants. Now tho this Conſideration alone may ſeem not to bear much weight, yet being joyn'd to the two former they do mutually ſtrengthen each other. And indeed all the Laws of Motion which are as yet diſcovered, can give but a very lame account of the forming of a Plant or Animal. We ſee how wretchedly *Des Cartes* came off when he began to apply them to this Subject; they are form'd by Laws yet unknown to Mankind, and it ſeems moſt probable that the *Stamina* of all the Plants and Animals that have been, or ever ſhall be in the World, have been formed *ab Origine Mundi* by the Almighty Creator within the firſt of each reſpective kind. And he who conſiders the nature of Viſion, that it does not give us the true magnitude, but the proportion of things, and that what ſeems to our naked Eye but a Point, may truly be made up of as many parts as ſeem to us to be in the whole viſible World, will not think this an abſurd or impoſſible thing.

But the ſecond thing which later diſcoveries have made probable is, that theſe Animalcles are originally *in Semine Marium & non in fœminis.* And this I Collect from theſe Conſiderations. 1. That there are innumerable *Animalcula* diſcovered *in Semine Maſculo omnium Animalium.* Mr. *Leewenhoeck* has made this ſo evident by ſo many Obſervations, that I do not in the leaſt queſtion the truth of the thing. The reaſon of their multitude, and ſome of the difficulties which ariſe thereupon, he has cleared to very good purpoſe, ſo that I ſhall not repeat them. 2. The obſerving the Rudiments of the *Fœtus* in Eggs, which have been fecundated by the Male, and the ſeeing no ſuch thing in thoſe which are not fecundated, as appears from *Malpighius* his Obſervations, make it very probable that theſe Rudiments proceed originally from the Male, and not from the Female. 3. The reſemblance between the Rudiments of the *fœtus in Ovo*, both before and after Incubation, and the *Animalcule*, makes it very probable that they are one and the ſame. The ſame ſhape and figure which Mr. *Leewenhoeck* gives us of the *Animalcule*, *Malpighius* likewiſe gives of the Rudiments of the *Fœtus*, both before and after Incubation, yea, and even the *Fœtus*'s of Animals do appear ſo at firſt to the naked Eye, ſo that Dr. *Harvey* does acknowledge that all Animals, even the moſt perfect are begotten of a Worm, *De Gen. Anim. Ex.* 18. 4. This gives a rational account of many *Fœtus*'s at one Birth, eſpecially that of the Counteſs of

Holland, and how at leaſt a whole Cluſter of Eggs in a Hen are fecundated by one Coition of the Male. 5. This gives a new light as it were to the firſt Prophecy concerning the *Meſſiah*, that the Seed of the Woman ſhall bruiſe the Head of the Serpent, all the reſt of Mankind being thus moſt properly and truly the Seed of the Man. 6. The Analogy I have already mentioned, which we may rationally ſuppoſe between the manner of the propagation of Plants and Animals, does likewiſe make this probable. Every Herb and Tree bears its Seed after its kind, which Seed is nothing elſe but a little Plant of the ſame kind, which being thrown into the Earth, as into its *Uterus*, ſpreads forth its Roots and receives its nouriſhment, but has its form within its ſelf, and we may rationally conjecture ſome ſuch Analogy in the Propagation of Animals.

The third Particular which later Diſcoveries make probable, is that Animals cannot be form'd of theſe *Animalcula* without the *Ova in fœminis*, which are neceſſary for ſupplying of them with proper Nutriment: And this theſe Conſiderations ſeem to evince. 1. It is probable that an Animalcle cannot come forward if it do not fall into a proper *Nidus*. This we ſee is the *Cicatricula* in Eggs, and tho a Million of them ſhould fall into an Egg, none of them would come forward, but what were in the Center of the *Cicatricula*, and perhaps the *Nidus* neceſſary for their formation is ſo proportion'd to their bulk, that it can hardly contain more than one Animalcle; and this may be the reaſon why there are ſo few Monſters. This we ſee is abſolutely neceſſary in *Oviparis*, and the only difference which ſeems to be between them and the *Vivipara* in this matter is in this, that in the latter the *Ova* are properly nothing more but the *Cicatricula* with its *Colliquamentum*, ſo that the *Fœtus* muſt ſpread forth its roots into the *Uterus* to receive its nouriſhment; but the Eggs in *Oviparis* may be properly term'd an *Uterus* in relation to the *Fœtus*; for they contain not only the *Cicatricula* with its *Amnion* and the *Colliquamentum*, which is the immediate nouriſhment of the *Fœtus*, but alſo the materials which are to be converted into that *Colliquamentum*, ſo that the *Fœtus* ſpreads forth its roots no farther than into the white and yolk of the Egg, from whence it derives all its nouriſhment. Now that an Animalcle cannot come forward without ſome ſuch proper *Nidus*, Mr. *Leewenhoeck* will not readily deny; for if there were nothing needful but their being thrown into the *Uterus*, I do not ſee why many hundreds of them ſhould not come forward at once; for as to what Mr. *Leewenhoeck* ſays, that one of them would bedwarf and choak the reſt; this might fall out in proceſs of time: but at firſt I do not ſee why many of them ſhould not grow together, whilſt ſcattered in ſo large a Field: (and yet no ſuch thing is obſerved) if there were not an abſolute neceſſity of a *Cicatricula* for their growth and thriving. Now 2. That this *Cicatricula* is not originally in *Utero*, ſeems evident from the frequent Conceptions which have been found *extra Uterum*: Such as the Child which continued twenty ſix years in the Woman of *Tholouſe*'s Belly, mentioned *Numb.* 139. of the *Phil. Tranſ.* And the little *Fœtus* found in the *Abdomen de St. Mere*, together with the Teſticle torn and full of clotted Blood recorded *Numb.* 150. both taken out of the Journals *des Scavans*: Such alſo ſeem to be the *Fœtus* in the *Abdomen* of the Woman of *Copenhagen*, mentioned in the *Nouvelles des Lettres*, for *Sept.* 85. *pag.* 996. all the Members of which were eaſily to be felt thro the Skin of the Belly, and which ſhe had carried in her Belly for four Years; And the ſeven Years Gravidation related by Dr. *Cole*, *Numb.* 172. of the *Tranſact.* That theſe two were undoubtedly *extra Uterum* is uncertain, becauſe the laſt was not opened after her death, and the former may be yet ſtill alive. Now grant-

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ing once the neceſſity of a proper *Nidus* for the formation of an Animalcle into the Animal of its reſpective kind; theſe Obſervations make it probable that the *Teſtes* are the *Ovaria* appropriated for this uſe; for tho the Animalcles coming thither in ſuch Caſes may ſeem to be extraordinary, and that uſually the Impregnation is *in Utero*; yet it may be collected from hence, that the *Cicatriculæ* or *Ova* to be impregnated are in *Teſtibus fœmineis*; for if it were not ſo, the accidental coming of Animalcles thither could not make them come forward more than in any other part of the Body, ſince they cannot be formed and nouriſhed without a proper *Nidus*. But 3. It is acknowledged by all, that the *Fœtus in Utero* for ſome conſiderable time after Conception has no Connexion with the Womb, that it ſits wholly looſe to it, and is perfectly a little round Egg with the *Fœtus* in the midſt, which ſends forth its Umbilical Veſſels by degrees, and at laſt lays hold on the *Uterus*. Now from hence it ſeems evident that the *Cicatricula*, which is the Fountain of the Animalcles nouriſhment, does not ſprout from the *Uterus*, but has its *Origine* elſewhere, and falls in thither as into a fit Soil from whence it may draw Nutriment for the growth of the *Fœtus*: elſe it cannot be eaſily imagined how it ſhould not have an immediate Connexion with the *Uterus* from the time of Conception. If you joyn all theſe three Conſiderations together, *viz.* that an Animalcle cannot come forward without a proper *Nidus* or *Cicatricula*; that there have been frequent *Fœtus's extra Uterum*; and that they have no *Adhæſion* to the *Uterus* for a conſiderable time after Conception, they ſeem to make it evident that Animals cannot be form'd *ex Animalculis* without the *Ova in Fœminis*. To all theſe I ſhall ſubjoyn the propoſal of an *Experimentum Crucis*, which may ſeem to determine whether the *Teſtes Fœmineæ* be truly the *Ovaria*, viz. Open the *Abdomen* of the Females of ſome kinds, and cut out theſe Teſticles, and this will determine whether they be abſolutely neceſſary for the formation of Animals.

There are ſome difficulties propoſed againſt this Conjecture, which I think may be eaſily reſolved. Some object the diſtance between the *Tubæ* or *Cornua Uteri* and the Teſticles; but to this is oppoſed by *Swammerdam* and others, the like diſtance between the *Infundibulum*, in Hens and Frogs, and the Ovary, and yet it cannot be denied that the Eggs are tranſmitted thro this into the *Uterus:* and beſides *R. de Graef*, and others, have by repeated Obſervations found that the *Cornua Uteri* do at certain times after Conception, embrace the *Teſtes* on both ſides the *Uterus*. They object in the ſecond place the great diſproportion between the pretended Eggs in the Ovary, and the Aperture of the *Tubæ* or *Cornua Uteri*, the former being a great deal bigger than the latter: but both *R. de Graef* and *Malpighius* have cleared that matter by making appear, that theſe Bladders in the Ovary are not the *Ova*, but ſerve to form the *Glandules* within which the *Ova* are formed, which break through a ſmall *Papilla* opening in the *Glandule*, which bears a proportion to the Aperture of the Tube. They object 3. The difficulty to conceive how theſe Eggs ſhould be impregnated *per ſemen Maris*, both becauſe there is no Connexion between the *Tubæ* and the Ovary for its tranſmiſſion, and for that Dr. *Harvey* could never diſcover any thing of it in *Utero*. As to the laſt, Mr. *Leewenhoeck* has cleared that difficulty by the diſcovery of innumerable *Animalcula Seminis Maris in Cornubus Uteri*, and thoſe living a conſiderable time after Coition. *Numb.* 174. of the *Tranſact*. And as to the former we may either ſuppoſe that there is ſuch an Inflation of the *Tubæ* or *Cornua uteri tempore Coitionis*, as makes them embrace the *Ovaria*, and ſuch an approach of the *Uterus* and its *Cornua*, as that it may eaſily tranſmit the Seed into the Ovary; or elſe that the *Ova* are impregnated by the

Animalcles after they deſcend into the *Uterus*, and not in the Ovary; the former ſeems probable for this reaſon, that at leaſt a whole Cluſter of Eggs in a Hen will be fecundated by one tread of the Cock; now this Fecundation ſeems to be in the Vitellary, and not in the *Uterus*, as the Eggs paſs along from day to day, for it can hardly be ſuppoſed that the Animalcles ſhould ſubſiſt ſo long, being ſcattered looſely in the *Uterus*, as to wait there for many days for the fecundation of the Eggs as they paſs along. The latter conjecture has this to ſtrengthen it, that the Animalcles are found to live a conſiderable time in the *Uterus*, and that if they ſhould impregnate the *Ova* in the Ovary its ſelf, the *Fœtus* would encreaſe ſo faſt, that the *Ova* could not paſs thro the *Tubæ Uteri*, but would either burſt the Ovary, or fall down into the Abdomen from the Orifices of the *Tubæ*; and that from hence proceed thoſe extraordinary Conceptions in *Abdomine extra Uterum*. But, 4. Mr. *Leewenhoeck* Numb. 147. of the *Tranſact*. to weaken the third Conſideration about the Conceptions being like unto an *Ovum* in the Womb, propoſes a Parallel between theſe Animalcles and Inſects, and inſinuates that as the latter caſt their Skins and appear of another ſhape, ſo the other which at firſt ſeem like Tadpoles, may caſt their outer Skin and then be round, and that this may be the occaſion of the round Figure of the Conception in the Womb. To this it may be replied, that according to Mr. *Leewenhoecks* own ſentiment, the Animalcles cannot come forward if they do not find the *Punctum* or proper place for their nouriſhment, to which it ſeems they muſt have ſome *Adhæſion*. Now the Conception in *Viviparis* is not faſtned unto the Womb for many days, nor does adhere to any point of it, ſo that it ſeems this roundiſh Body is not the Animalcle thus chang'd after having caſt an outer Skin, but is rather the *Cicatricula* or little Egg, into which the Animalcle has entred as its *Punctum*

or place of nouriſhment: elſe I do not ſee why they ſhould not be adhering to the Womb from the firſt Conception, or why (as I have ſaid) many hundreds of them are not conceived and formed together, *&c.*

Obſervatio Mercurii ſub Sole viſi, ultimo Octobris 1690. Stil. vet. habita Noribergæ ab Aſtronomo accuratiſſimo Johanne Phil. Wurtzelbaur, atque ab eodem cum Reg. Societate communicata.

Mercurius ſub Sole inque ejus diſco, hoc ſeculo vix aliquoties ope Teleſcopii, ante hujus inventionem autem ab orbe condito nuſquam gentium obſervatus eſt. Sub finem Octobris labentis hujus anni denuò obſervandum ex Tabb. Rudolphinarum calculo celeberrimi Logiſtæ prædixerunt. Cùm verò nemo qui delicias Uraniæ vel primis deguſtârit labris, rariſſimum hujuſmodi & jucundiſſimum Phænomenon contueri non ſumma aviditate exoptâret: eo ipſo & ego invitatus illi obſervando invigilare decrevi, nihil morans, quòd cœlum jam ab aliquot ſeptimanis nube ferè continuâ obductum vix aliquid ſpei ſucceſſus optati conceſſerit: Præcedentis equidem diei veſpera noctiſq; primordia nubes aliquantulum diſſipârunt, ſed nox adulta Cœlum ab omni parte denuò obvelavit, ut hora ante Solis exortum totum obductum extiterit, nec ipſemet Sol jam ſatis elevatus ſuis radiis invidos hoſce vapores penetrare valuerit: Paulò verò poſtquam Zephyri à parte occiduâ Horizontem repurgare cœperunt, ingruens illinc ſerenitas addidit animum, ut voti compotem me futurum haud amplius deſperaverim; nubes etiam in plagâ orientali retro cedere, & ad horizontem conſtipari videns, Tubum illò ubi emerſio Solis è nebulis expectanda erat *direxi; & poſtquam emergens ejus diſcus ad tabulam obſervatoriam affluxerat, illum ſupernè macula quadam mediocri affectum animadverti, quam etiam niſi præſentia Mercurii expectanda fuiſſet, nec illa motum ſuum ſatis evidenter acceleraviſſet, pro ſolari arripuiſſem. Sed utinam paulò citiùs Sol è nebulis evaſiſſet, ut Mercurii viam itinerariam & angulum orbita ejus cum Eclipticâ notare licuiſſet; nam diſtantem vix ultra dimidium à limbo digitum jamjam exiturum deprehendimus: acceſſit etiam auræ haud ſatis deſæcatæ incommodum. Diſcus enim Solis ceu trans undam limpidiſſimam apparuit, ideoq; limbum & ipſi approperans Mercurii corpus ob undulationem terminis præciſis cernere non licuit: tandem cum limbi mutuo contactu ſe ſtringerent, in confinio lucis ſolaris exiens Mercurii corpus opacum rotunditatem ſuam, quam antea ſub figura oblonga oſtenderat, recuperavit; ita ut ejus diameter majori priſtinæ Ellipſeos diametro ferè æquaretur: & poſtquam limbus uterq; ad minutum ferè ſibi invicem adhæſitare viderentur,* H. 8. Min. 36. *Oſcillatorii noſtri Mercurius totus diſco exiiſſe obſervatus eſt. Reliqua momenta & quæ pro correctione eorum notabantur Culminationes & Altitudines Tabella ſequens exhibet.*

Mercurius in Sole obſervatus Noribergæ *A.C.R.* 1690. Die ult. Octob. a *Joh. Phil. Wurzelbaur.*

Temp. Horol. Oſcillat.						Tempora Supputata		
H.	M.	S.	*Die 30 Octob. P.M.*			H.	M.	S.
6	32	00	*Culminat os Pegaſi*			6	28	45
9	00	00	*Culm. Cap. Andromedæ*			8	52	17
9	04	00	*Culm. Jupiter.*					
			Die 31 Octob. A.M.					
6	30	00	*Cœlum undiq; nubibus obductum ut*					
7	30	00	*Solis exortus obſervari nequiret.*					
8	00	00	*Nubes ob occaſu verſ. Ortum propelluntur, & vi Ventorum ibid. ad Horzontem conſtipantur.*					
8	30	00	*Sol è nubibus emerſit, Mercurius in diſco ejus ſupernè in Tab. obſervatoria, a Verticali ad dextram (reverâ ad lævam) diſtans plus quam dim. dig. a limbo exiturus apparuit.*					
8	36	0	*Mercurius poſtquam undulanti limbo Solis ad Min. temporis adhæſerat, exiit ad* 14° *à Zenith ſeptentrionem verſus.*					
H.	M.	S.		°	′	H.	M.	S.
8	49	00	*Altitudo Solis*	10	05	8	38	38
8	59	45	*Alt. Solis*	11	10	8	47	48
9	07	10	*Alt. Solis*	12	10	8	56	24
9	50	00	*Alt. Sol.*	16	28	9	38	07
11	01	30	*Alt. Sol.*	21	31	10	56	32

Ratio diãetrorũ Solis & nuclei Mercurii, dum Lucido Solis diſco immorabatur, quantum per auram haud ſatis defæcatam conjici poterat, erat ut 1000 *ad* 8 ½. *Poſtea quam ad limbum Solis pervenerat, ejuſq; limbo undulanti ad Minutum ferè adhæſitârat & genuinam rotunditatem ſuam (quæ antea ex luce Diſci Solaris formam quaſi ellipticam mentiebatur) recuperârat, erat ut* 1000 *ad* 12 ⅓

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An Account of an Experiment of the Injection of Mercury into the Blood, and its ill Effects on the Lungs; as it was communicated to the Royal Society by their late worthy Member A. Moulin, M. D.

I Have promiſed laſt Meeting to give my Reaſons this day why I conceive Mercury to be an Enemy to the Lungs: I ſhall only give an account of an Experiment I made on a Dog at Mr. *Boyle*'s laſt Autumn, which I take to make out what I then promis'd. I injected into the jugular Vein about an ounce and half of crude Mercury, and obſerv'd the Dog ſoon after to have a dry ſhort Cough, which by pretty intervals ſeiz'd him. I ſew'd up the Wound, and ſent away the Dog to be look'd after, obſerving no other effect of the Quick-ſilver at that time. But about two days after I ſaw him, and found him troubled with a great difficulty of breathing, making a noiſe like that of a broken-winded Horſe; there was no Tumor about the root of his Tongue, neither was there any ſwelling found in the Maxillary or Parotide Glandules, though I diligently ſought for it: neither was he obſerv'd to drivle, though I order'd him warm Broth in expectation of a Salivation. The fourth day after the injection of the Mercury he dyed, being for the two days before ſo troubled with an *Orthopnœa*, that he could ſleep only when he leaned his head againſt ſomething. I open'd him, and found about him a pint of bloody *Serum* extravaſated in the *Thorax*. I found alſo the outſide of the Lungs in moſt places bliſter'd, for what I at firſt took to be ſome preternatural dilatations of the *Veſiculæ* of the *Bronchiæ*, were only Bliſters or a ſeparation of the common Integuments of the Lungs from their ſubſtance. Some of theſe were larger than a Rouncival-Pea, others were ſmaller, but moſt of them contain'd Mercurial Globules, to be ſeen even without opening in ſeveral of them, thro' the outward Skin; opening diſcover'd it in moſt of thoſe that I had the curioſity to examine. Several of theſe I found broken, and upon a little preſſure obſerv'd the Mercury to run out, and with it a little *Sanies*: but upon a pretty ſtrong preſſure, I obſerv'd that a great quantity of that *Sanies* iſſu'd out.

When I open'd the right Ventricle of the Heart, I found ſome Particles of the Quick-ſilver in the very midſt of coagulated Blood lodged there, and in that alſo contain'd in the *Arteria pulmonalis*. I obſerv'd moreover blood coagulated after a very different manner (which I want words to expreſs) from what I have ſeen at any other time, notwithſtanding the various Methods I had us'd to coagulate it, and this in the *Interſtices* between the *Columnæ* of the aforeſaid Ventricle; and in this a greater quantity of Quick-ſilver than any where elſe in the Dog. This *Coagulum* was in the *Vertex* of the Ventricle, adhering pretty cloſely to the *Columnæ* and *Parietes*.

Opening the left Ventricle, I found a very tenacious Blood coagulated and ſticking firmly to the great Valve, including the Tendons of it, and a little reſembling a *Polypus*. In this Ventricle I ſearch'd diligently for Mercury, but found none; whence it may appear, that the Mercury paſs'd no farther than the extremities of the *Arteria pulmonalis*: This occaſion'd the aforeſaid Bliſters, and forced its way through the common Coat of the Lungs, partly by its weight, and partly by the propulſion of freſh Blood to the ſame extremities which by the Mercury were ſtop'd in its motion,and conſequently forced its paſſage through that which moſt readily gave way, namely the common Coat of the Lungs.

I open'd the *aſpera Arteria* down to the very *Bronchiæ*, but could find no Mercury in it, though I ſearch'd diligently for it. Each of the ſubdiviſions as well as diviſions of the *Bronchiæ* was fill'd with a *Sanies*, which

when

when I waſh'd away, I found Globules of Mercury in many places under the *Bronchiæ*, and upon Examination they prov'd to be in the *Arteria pulmonalis.* I have preſs'd theſe Globules backwards and forwards, and made ſome of them get out at the holes made in the *Veſiculæ* above deſcrib'd. I took ſome pains to find where the *Sanies* was receiv'd into the *Bronchiæ*, but could not ſatisfie my ſelf. From hence may appear the danger of uſing Mercury in humane Bodies, ſo as that it may get into the Maſs of Blood, eſpecially into the Lungs; they wanting that brisk ſtrong motion which the Muſcles have in other parts, which are able to force it along with the Blood, in order to the raiſing a Salivation. Their lax ſpongy Texture makes them extreamly unfit for clearing themſelves of ſo troubleſom a Gueſt as Mercury is. That it has this Effect on humane Lungs, is plain from what we daily ſee in perſons that have been often-flux'd, who are after obſerv'd to dye of Conſumptions that will not give way to Medicine.

Medicina Hydroſtatica, *or Hydroſtaticks applied to the* Materia Medica, *ſhewing how by the Weight that divers Bodies uſed in Phyſick have in Water, one may diſcover whether they be Genuine or Adulterate. By the Honourable* ROBERT BOYLE *Fellow of the Royal Society*, London, 8^vo 1690. *Printed for* Sam. Smith.

THE Honourable Author deſigns in this Treatiſe to ſhew, that by weighing Bodies in Water, comparing their weight in Air, and from thence deducing the proportion of weight to Water, the Specific Gravity of Bodies may be more exactly determined; counterfeits diſtinguiſht from Genuine, and the mixture of mineral Particles in Stone diſcover'd. *Archimedes* firſt obſerv'd That a Body heavier than Water, weighs leſs in

Water than in the Air, by the weight of as much Water as is equal to it in Bulk. The difference then of the Weights in Air and Water, gives the weight of ſo much Water, and dividing the greater number by the leſſer, the Quotient compar'd to unity, will be the proportion of the Weights of the ſolid Body and Water.

Rock Cryſtal, and the *Icecles* of *Vaults* are us'd as the Standard, (being the moſt homogeneous and ſimple) to compare other Stony Bodies with, which if found heavier are preſum'd to contain matter heavier *in ſpecie*. They are to water as $2\frac{3}{5}$ to 1. *Lapis Hæmatites* almoſt double to the Standard, and *Iron* is diſcover'd in it by the *Styptical* taſte of its Flowers, and by the black colour when mixt with Galls. *Lapis Lazuli* having a vomitive Quality as 3 to 1. *Loadſtone* more than 4 to 1. *Lap. Calaminaris*, us'd in the turning Copper into Braſs, and of a Quality very reſtringent, appears to weigh as almoſt 5 to 1. *Coral*, truly therefore eſteem'd a *Lithodendron* ſomewhat exceeds *Cryſtal*. *Pearl* near the weight of *Cryſtal*. *Calculi Humani* and *Bezoars* (Animal Concretions) amount not to twice the weight of Water, and are by a fifth part lighter than *Cryſtal*, by which counterfeit *Bezoars* are detected : ſuch an one being found as heavy as a mineral. It is further obſerved that counterfeit *Crabs Eyes* are of much more weight than natural. *Falſe Stones* are eaſily detected, the *Mineral* which gives the *Colour* making them preponderate to true *Gems*. *Falſe Coyns* in this manner are eaſily diſcoverable.

Our Author having in theſe particulars ſhewn in what manner all ſolid Bodies heavier than Water may be compar'd to one another, and not only their Specific Gravity, but their qualities very often detected; comes now to conſider and propoſe, 1. How Bodies *lighter* than Water may be examin'd in it, *viz.* by adding Lead to Wax or Fir-wood, and ſubducting for the heavy Body ſo added. 2. How Fluids, as Mercury, or Chymical Oyls of Cloves, *&c.* or *Bodies* diſſoluble in *Water*, as *Sublimate*, *Alum*.

Vitriol, or Fragments of any brittle Body, *viz.* by a little Glaſs Bucket or Voil ſtopt, which may receive theſe Bodies, adding ſo much Water as will fill the *Spatiola* of the *Fragments*, up to the brim of the Glaſs; for which allowance muſt be made in the computation of the weight, both in the *Air* and *Water*.

Sublimate which wants its due proportion of ☿ will be this way diſcover'd, and *Roman Vitriol* mixed with *Alum*. It is here obſerv'd that ☿ is to water almoſt as 14 to 1. But the more eaſie and ſimple Method of weighing Bodies diſſoluble in Water, is to uſe the thinner *Oils*, ſuch as *Oil* of *Turpentine* of the firſt riſe in diſtillation.

Having hitherto examin'd Bodies by Water and Oils, our Author proceeds to examine the weight of *Liquors* by weighing *Solids* in them. For if a heavy Body in Water loſe ſo much of its weight as the quantity of Water weighs that is of an equal bulk to the Body, the proportion of the weight of all *Liquors* will be eaſily obtained. For inſtance, A piece of *Amber* of between 3 and 4 Drams weighed in Water 6 ¾ gr. in *Red French Wine* 8 ½ gr. in *Brandy* 17 ⅛ gr. in rectified Spirit of Wine 34 ½ gr. This way may be apply'd to compare all ſorts of Liquors, as Wine in the Muſt, Mature, decaying, vappid. Juices of Herbs, Beer, Sider, *&c.* But Acids are heavier than Water. Hence the Degrees of their Acidity may be obſerv'd. Of Waters, Rain Water ſeems the lighteſt, and ſcarce a 1000th part difference diſcover'd in any of them. This is particularly apply'd to the famed Water of *Ganges*, tho Travellers aſſert an extraordinary lightneſs in it.

In the laſt place the Bulk of ſolid Bodies may be found out by this Method. For ſince a Cubical Inch of Water weighs 256 gr. and as much of Oil of *Turpentine* 221 gr. if a Body of any magnitude and irregular ſhape loſe ſo much or more times that weight in Water or Oil, it is of a Magnitude equal to one or more Cubical Inches.

In the ſubjoyn'd Tract, our Author treats particularly of Minerals, and obſerves that *Emery* is as 4 to 1 to Water. *Jet* lighter then *Cryſtal*; ſo is *Foſſil Amber*, *Sulphur Vive*, *Engliſh* and *Venetian Talk*. In an *American Talk* heavier than *Cryſtal*, a Metalline Subſtance was obſerv'd. *Fine Gold* is as 19 to 1 to Water. Hence any Fallacious Mixture us'd by the *Negroes* in *Gold-Sand* may be obſerv'd. *Braſs* is not quite half ſo heavy as *Gold*, &c. *The whole Book is made up of curious Remarks and Experiments, ſuch as uſually proceed from its renowned Author, whoſe ſingle Name is more than ſufficient to recommend it to the peruſual of the Studious Naturaliſt.*

FINIS.

Numb. 193.

PHILOSOPHICAL TRANSACTIONS.

For the Months of *March*, *April*, *May*, and *June*, 1691.

The CONTENTS.

1. A*N account of a large and curious Map of the Great* Tartary *lately Publiſh'd in* Holland *by Mr.* Nicholas Witſen, *being an Extract of a Letter from the Author thereof to the Honourable Sir* Robert Southwell *Knt.* *and* Preſident *of the* R. Society. (2.) *A diſcourſe tending to prove at what* Time *and* Place Julius Ceſar *made his firſt Deſcent upon* Britain: *Read before the* R. Society *by* E. Halley. (3.) *A Receipt for the Curing of* Caſtorium *according to the method us'd in* Ruſſia. (4.) *Obſervations on the making of* Cochineal, *according to a Relation had from an Old* Spaniard *at* Jamaica, *who had lived many years in that part of the* Weſt-Indies *where great quantities of that rich Commodity are yearly made.* (5) *Some Experiments made of the force and preſſure of the Water in great Depths, made and Communicated to the* R. Society *by a Perſon of Honour.* (6.) Lumbricus Hydropicus; *or an Eſſay to prove that the* Hydatides *often met with in morbid Animal Bodies, are a Species of Worms or imperfect Animals. By that learned and curious Anatomiſt* Edward Tyſon, M. D. *and* R. Soc. S. (7.) De viſibili Conjunctione Inferiorum Planetarum cum *Sole*, Diſſertatio Aſtronomica, Authore *E. Halley*. (8.) *Some Obſervations made on the* Spawn *of* Frogs, *and of the Production of* Todpoles *therein, by the learned and curious* Richard

Waller *Eſq*; Reg. S. Secret. (9.) *An account of a* Ruminating Man, *lately Living at* Briſtol, *given in to the* R. Society *by the Experienced and learned* Frederick Slare, M. D. *and* Reg. Soc. S. (10.) *A Letter from that incomparable Botaniſt Mr.* John Ray, R. S. Soc. *giving an account of the* Phytographia *of Dr.*Leonard Plukenet,M.D. *lately Publiſhed.*

An Account of a large and curious Map *of the Great* Tartary, *lately Publiſh'd in* Holland, *by Mr.* NICHOLAS WITSEN, *being an Extract of a Letter from the Author thereof, to the Honourable Sir* ROBERT SOUTHWELL *K^nt.* *and* Preſident *of the* Royal Society.

The Honourable NICHOLAS WITSEN *late Ambaſſadour into* England, *and now one of the Principal Burgomaſters of* Amſterdam, *having ſent ſeveral of his New Maps of* Tartary *to the Fellows of the* Royal Society,*the Honourable their* Preſident, *was pleaſed to write unto him as followeth.*

SIR,

I Have lately had a great Effect of your Bounty in the Maps of *Tartary*. This is *Columbus* like, the Diſcovery of a New World; at leaſt Tydings of thoſe Parts, which from the beginning have layn in the Dark. But the Enterpriſe being ſo vaſt, and the ſucceſs ſo unexpected; the Publick are very impatient to be told by what Magick you have been able to maſter this Work. For it looks in one Part no leſs difficult then a Geographical Deſcription of the Bottom of the Sea; I mean as to thoſe impenetrable Deſerts, the endleſs Boggs and Marſhes, the inacceſſible Mountains and thoſe mighty Tracts, which by their Climate are rendred uninhabitable; ſince all theſe ſeem by Nature to have been condemned to an everlaſting Solitude.

Now for the reſt, when I conſider that the Caravans paſſing between *Muſcovy* and *China* are not frequent; that they are confin'd to certain Paths and Lines of Trade; That the Merchants and common Travellers mind nothing but the Security and Certainty of the Journey, and the Profit that enſues; And that thoſe who ſhould, inform them of Extents and Boundaries, are a Rambling and uncultivated Generation, and of various Languages. If after all theſe Impediments, you ſhall yet be able to ſhew the Credibility of your Survey, you need think no more of Fame, but only pray for Humility.

To which Mr. Witſen *was pleaſed to Anſwer to the Effect following.*

SIR,

'TIS almoſt 28 years ſince I Travelled into *Ruſſia*, and being there merely for my own Satisfaction, I not only Converſed with the Inhabitants of thoſe Countreys, but with *Tartars* of all ſorts. There I grew firſt informed not only in the Situation of thoſe Parts, but of ſuch Countries as lay very remote. I have not ceaſed from that time, by various Methods I have found, to ſend Letters unto, and receive Anſwers from the moſt Northern, and North-Eaſt parts of the World. For I have maintain'd a conſtant Correſpondence in *Moſco*, *Aſtracan*, *Georgia*, *Iſpahan*, *Polonia*, and *Conſtantinople*. I have had Letters every year from *Pekin*, the chief City of *China*. I have gathered Volumes of Journals and Regiſters, which ſet forth the Names of Mountains, Rivers, Cityes and Towns, together with a vaſt number of Drafts made by my own Order, which deſcribe the Territories that I have mentioned.

'Tis from this Fund, which has been gathering for ſo many years, and by comparing and adjuſting all theſe Materials, and by perſevering without intermiſſion therein, that the Map is made up.

After all, I am far from thinking it has no faults, 'tis very well if ſuch as are found, be not many, or very groſs. I confeſs my own greateſt doubts are about the ſtretching of the Sea-Coaſts. And 'tis therefore that I expreſs them in a faint and pale Colour, to ſignifie the uncertainty thereof. But as to the Latitudes, I have more aſſurance of their being well noted, and ſuſpect but little miſtakes, if there be any therein.

I am yet in ſuſpence whether the North-Eaſt-Point which you ſee bearing off in the Map, may run quite on to *America*; or how far thither-ward it may reach.

I formerly thought *Nova Zembla* had been a Continent, and when I wrote my Opinion herein to Mr. *Oldenbourg*, he put it into one of his Tranſactions. But I have ſince been better informed, and retracted that Error. And whereas the late Monſieur *Voſſius* would needs perſuade himſelf, as well as he did others to their Ruine, that there was a paſſage to *Japan* by the North, and that the *Tartarian* Countreys behind *Nova Zembla* did immediately decline towards the South; I did always oppoſe it, and think I can even demonſtrate the Impoſſibility thereof. So that what he wrote to encourage Mariners to that attempt, was even directing them to the point of Death, as it afterwards enſu'd.

My intention is, if I Live, and may have leiſure for it, to make ſeveral particular Maps of the ſundry Countries contained in this General One, and to give the Deſcriptions which appertain to each.

A DISCOURSE tending to prove at what Time *and* Place, Julius Ceſar *made his firſt Deſcent upon* Britain: *Read before the* Royal Society *by* E. Halley.

Though *Chronological* and *Hiſtorical* Matters, may not ſeem ſo properly the Subject of theſe Tracts, yet there having, in one of the late Meetings of the *Royal Society*, been ſome Diſcourſe about the Place where *Julius Ceſar* Landed in *Britain*, and it having been required of me to ſhew the Reaſons why I concluded it to have been in the *Downs*; in doing thereof, I have had the good fortune ſo far to pleaſe thoſe worthy Patrons of Learning I have the honour to ſerve, that they thought fit to command it to be inſerted in the *Philoſophical Tranſactions*, as an inſtance of the great Uſe of *Aſtronomical Computation* for fixing and aſcertaining the Times of memorable Actions, when omitted or not duly delivered by the Hiſtorian.

1. The Authors that mention this Expedition with any Circumſtances, are *Ceſar* in his *Commentaries lib.* 4, and *Dion Caſſius* in *lib.* 39; *Livies* account being loſt, in whoſe 105*th.* Book, might poſſibly have been found the ſtory more at Large. It is certain that this Expedition of *Ceſars*, was in the Year of the *Conſulate* of *Pompey*, and *Craſſus*, which was in the Year of Rome 699. or the 55*th.* before the uſual Era of Chriſt: and as to the time of the year, *Ceſar* ſays that *Exiguâ parte æſtatis reliquâ*, he came over only with two Legions, *viz.* the 7*th.* and 10*th*, and all Foot, in about 80 Sail of Mer-

chant Ships, 18 Sail that were ordered to carry over the Horſe, not being able to get out at the ſame time from another Port, where they lay Wind-bound. He ſays that he arrived about the Fourth hour of the Day, *viz.* between Nine and Ten in the Morning, on the Coaſt of *Britain*, where he found the Enemy drawn up on the *Cliffs* ready to repel him, which place he thus deſcribes. *Loci hæc erat natura, adeo montibus anguſtis mare continebatur ut ex locis ſuperioribus in littus telum adjici poſſit*, by which the *Cliffs* of *Dover* and the *South Foreland*, are juſtly deſcribed, and could be no other Land, being he ſays in the 5*th.* Book of his Commentaries, *in Britanniam trajectum eſſe cognoverat circiter millium paſſuum triginta à continenti*, the *Cliffs* of the *North-Foreland* being at a much greater diſtance. Here he ſays he came to an Anchor, and ſtaid till the 9*th.* hour, or till about between Three and Four in the Afternoon, expecting till his whole Fleet was come up; and in the mean time called a Council of War, and advertiſed his Officers, after what manner they were to make their Deſcent, particularly in relation to the Suff of the Sea, whoſe motion he calls *celerem atq; inſtabilem*, quick and uneven. Then, *viz.* about Three in the Afternoon he weighed Anchor, and having gotten the *Wind* and *Tide* with him, he Sail'd about Eight Miles from the firſt place, and Anchor'd againſt an open and plain Shore.

2. Here he made his Deſcent, and having told us the oppoſition that was made, and the means he uſed to get on ſhore, he comes to ſay, that after he had been *Four Days* in *Britain*, the 18 Ships with his Horſe put to Sea, and were come in ſight of his Camp, when a ſudden Tempeſt aroſe, with contrary Wind, ſo that ſome of the Ships put back again, others were driven to the Weſtwards, not without great danger, and coming to Anchor, they found they could not ride it out: ſo when Night came on, they put off to Sea and returned

d from whence they came. *That ſame Night* it was *Full-Moon*, which makes the greateſt Tides in the Ocean, and they being ignorant thereof, their Galleys, which were drawn on ſhore, were filled by the Tide, *&c.*

3. Then he ſays that the day of the Autumnal Equinox being at hand, after ſome days ſtay, wherein there paſſed no Action becauſe he kept cloſe in his Camp by the ſhore; and not thinking it proper to ſtay till the Winter came on, he returned into *Gallia*: The next year he made a further Expedition with 5 Legions and a good Body of Horſe, but there is but little in the Hiſtory thereof ſerving to our purpoſe, excepting that he ſays he ſet Sail from the *Portus Icius* about Sun Set, with a gentle S. W. Wind, *leni Africo profectus*; that about Midnight it fell Calm, and being carried away with the Tide, by the time it was day, he found he had left *Britain* on the left hand; but then the Tide turning, they fell to their Oars, and by Noon reached that part of the Iſland where he Landed before, and came on ſhore without oppoſition, and then marched up into the Country, leaving his Ships at Anchor *in littore molli & aperto.*

4. This is all in *Ceſar* that is any thing pertinent, and I find no where elſe any thing to guide us farther, except one paſſage in *Dion Caſſius*, who ſpeaking of the firſt Landing of *Ceſar*, ſays οὐ μέντοι ϗ ᾗ ἔδει προσέσχεν, that is, as I Tranſlate it. But he Landed not where he intended, for that the *Britains* hearing of his coming, had poſſeſt all uſual places of Landing, Ἄκραν οὖν τινὰ προέχουσαν περιπλεύσας ἑτέρωσε παρεκομίσθη. Κἀνταῦθα τοὺς προσμίξαντάς οἱ ἐς τὰ τενάγη ἀποβαίνοντι νικήσας, ἔφθη τῆς γῆς κρατήσας, in my Engliſh. Wherefore doubling a certain head Land, he made to the ſhore on the other ſide, where he overcame thoſe that Skermiſhed with him at the waters edg, and ſo got well on

Land. Here I make bold to tranſlate the Words ἐς τὰ τενάγη, *at the waters edg*, which in *H. Stephens* Edition is interpreted *in paludibus*, but I have the Authority of *Suidas*, who ſays τέναγος, πελαγία ἰλὺς, or the Sea Mud, and is therefore properly the Ouſe on the Sea Shore, and by an eaſie Figure, may be put for the Shore itſelf, where ſuch Ouſe commonly is found.

5. From theſe *data*, That it was in the Year of the *Conſulate* of *Pompey*, and *Craſſus*; That it was *Exiguâ parte æſtatis reliquâ*, and Four Days before a Full-Moon, which fell out in the night time, The time of this Invaſion will be determined to a day: For by the Eclipſe of the Moon, whereof *Druſus* made ſo good uſe to quiet a Mutiny in the *Pannonian* Army, upon the News of the Death of *Auguſtus*, it follows that *Auguſtus* Died *Anno Chriſti* 14. which was reckoned *Anno Urbis conditæ* 767. and that this Action was 68 Years before, *viz.* in the 55*th.* Year before Chriſt Current. In which Year the Full Moon fell out *Auguſt* 30. after Midnight, or 31 in the Morning before day; and the preceding Full-Moon, was *Auguſt* 1. ſoon after Noon; ſo that this could not be the Full Moon mentioned, as falling in the day time: nor that in the beginning of *July*, it being not 10 days after the Summer ſolſtice, when it would not have been ſaid *exiguâ parte æſtatis reliquâ.* It follows therefore that the Full Moon ſpoken of, was on *Auguſt* 30. at Night, and that the Landing on *Britain* was *Auguſt* 26. in the Afternoon, about a Month before the Autumnal equinox; which agrees to all the Circumſtances of the Story in point of Time.

6. As to the Place, the high Land and Cliffs deſcribed, could be no other than thoſe of *Dover*, and are allowed to have been ſo by all, it remains only to examine whether the Deſcent was made to the Northward or Southward of the place where he firſt Anchored. The *data* to determine this, are firſt that it was Four days

before the Full Moon. 2. That that day by Three of the Clock in the Afternoon the Tide ran the ſame way he Saild. 3*ly*. That a S. by E. Moon makes High-Water on all that Coaſt, the Flood coming from the Southward: hence it will follow, that that day it was High-water there about Eight in the Morning, and conſequently Low-water about Two, wherefore by Three the Tide of Flood was well made up, and it is plain that *Ceſar* went with it, and the Flood ſetting to the Northward ſhews that the open plain ſhore where he Landed was to the Northward of the Cliffs, and muſt be in the *Downs*; and this I take to be little leſs than Demonſtration. A ſecond Argument is drawn from the Wind wherewith he ſet out on his ſecond Expedition, *viz.* S. W. as appears by the words *leni Africo profectus*, with which the Navigation of thoſe times would hardly permit a Ship to Sail nearer the wind than eight Points, or a N. W. Courſe; which would ſerve indeed to go into the *Downs*, but would by no means fetch the Low-land towards *Dengyneſs*, which is much about Weſt from *Calais*, and not more than W. N. W. from *Boulogne*, if it ſhall be ſaid that that was the *Portus Icius* from which *Ceſar* ſet out. Whence I take it to be evident that if *Ceſar* was not bound more Northerly than the *South-Foreland*, he could not have thought the *Africus* or S.W. Wind proper for his paſſage, which was then intended for the place where he firſt Landed the year before.

7. Juſtly to determine which the *Portus Icius* was I find no where ſufficient grounds; only *Ptolemy* calls the Promontory of *Calis-Cliffs* by the name of Ἴκιον ἄκρον, whence there is reaſon to conjecture, that the *Portus Icius* was very near thereto, and that it was either *Ambleteuſe* on one ſide, or *Calis* on the other. The ſame *Ptolemy* places Γισοῤῥιακὸν ἐπίνειον in the ſame Latitude with the ἴκιον ἄκρον, but ſomething more to the Eaſt, which ſeems to refute thoſe that have ſuppoſed the an-

cient Port of *Geſſoriacum* to have been *Boulogne*, whereas by *Ptolemy*'s poſition, it muſt be either *Dunkirk* or *Gravelingue*, but the former moſt likely, both by the diſtance from the Ἴκιον ἄκρον, being about 20 Miles or half a degree of Longitude to the Eaſt, or $\frac{2}{5}$ of the whole Coaſt of *Flanders*, which he makes but a degree and quarter from the *Acron Icion* to the mouth of the *Scheld* which he calls *Oſtia Tabudæ*: as alſo for that *Pliny* l.4.c.16. ſpeaking of *Geſſoriacum*, ſays the *Proximus Trajectus* into *Britain*, from thence is 50 Miles, which is too much unleſs *Geſſoriacum* were ſomething more Eaſterly than *Calis*: *Dion Caſſius* makes the diſtance between *France* and *Britain* 450 *ſtadia* or 56 Miles, and ſays likewiſe 'tis the neareſt, τὸ συντομώτατον. But this is in part amended by the explication given in the *Itinerary* of *Antoninus*, where the ſpace between *Geſſoriacum* and *Rutupium* is ſaid to be 450 *ſtadia*, (for this was the ordinary paſſage of the *Romans* into *Britain*,) *Rutupium* being more Northerly and *Geſſoriacum* more Eaſterly than the *termini* of *Ceſars* Voiage, and conſequently the diſtance greater than 30 Miles which *Ceſar* had obſerved: and now lately an accurate Survey has proved the diſtance between Land and Land to be 26 *Engliſh Miles* or $28\frac{1}{2}$ *Roman Miles*, which ſhews how near *Ceſars* eſtimate was to the truth.

A farther Argument (but not of equal force with the former becauſe of the modernneſs of the Author, who writ above 250 years after) may be drawn from the words of *Dion Caſſius*, where he ſays ἄκραν τινὰ περιέχουσαν περιπλεύσας ἑτέρωσε παρεκομίσθη, that after his firſt Anchoring he Sailed about a Promontory to the place where he Landed; now there are no other Promontories on all that Coaſt but the *South-Foreland* and *Dengyneſs*; the latter of which it could not be, becauſe *Ceſar* ſays he Sail'd but 8 miles, and the *Neſs* it ſelf is about 10 Miles from the South and neareſt end of the *Chalk Cliffs* by the Town of *Hith*; and to have gone round that Point to the other ſide, the diſtance muſt have been much greater. So that the Promontory ſpoken of by *Dion*, muſt needs be the *South Foreland*, and *Ceſar* muſt Anchor near over againſt *Dover*, from whence Sailing 8 Miles, he would double a Head-land and come to the *Downs*; which is ſuch a Coaſt as he deſcribes in one place by *apertum ac planum littus*, and in his *5th.* Book by *molle ac apertum littus.* As to *Dions* word εἰς τὰ τενάγη, what I have already ſaid about it ſeems ſufficient to prove that he means no more than the waters edg; and the *Etymologiſts* derive it from τέγγω *madefacio*, becauſe the waſh and breach of the Sea does always keep it wet. And this word τὰ τενάγη is uſed by *Polybius* for the Sea Ouſe; and in another place he ſpeaks of the difficulty of Landing at the mouth of a River διὰ τὴν τεναγώδη πάροδον, *ob limoſum acceſſum*, ſo that it is not to be doubted that it ought to be rendred in this place, *ad vadum maris* rather than *in paludibus*. And ſo this objection againſt the aſſertion that *Ceſar* Landed in the *Downs*, which is known to be a firm Champain Country without Fenns and Moraſſes will be removed; and the whole Argument will 'tis hoped be admitted by the Curious.

A Receit for the Curing of Caſtorium, *according to the method us'd in* Ruſſia.

TAke the Beaver Stones and get the Milk out of them as clean as you can, then ſet upon the Fire a Skillet or Kettle with Water, big enough to contain the quantity of Stones you have to cure: let the water Boil, and put into it half a ſhovel full of clean Wood Aſhes, then tie the Stones together in couples and put them into the water, and let them Boil therein for half a quarter of an Hour. Then take ſome Birch-Bark and lay it on the Fire, and let the Stones be well ſmoaked over it for the ſpace of an hour, until they are well dried in the ſmoak; then hang them up in a Kitchin or in the Air for a week or more, until they are perfectly dry and hard, after which they may be pack'd up in a Cask or otherwiſe for Tranſportation. If there be more Stones than will conveniently go into the Skillet or Kettle, you may make another boiling of them, and add a proportion of freſh Aſhes and order them as before.

Obſervations on the making of Cochineal, *according to a Relation had from an Old* Spaniard *at* Jamaica, *who had lived many years in that part of the* Weſt-Indies *where great quantities of that rich Commodity are yearly made.*

THE Inſect whereof it is made he confirms to be the ſame which we call the Lady-Bird, *alias* Cow-Lady, which he ſays at firſt appears like a ſmall bliſter or little knob upon the Leaves of the Shrub on which they breed, which afterwards by the heat of the Sun, become a live Inſect, as above, or ſmall Grub. This Shrub is allowed by ſeveral Authors to be the ſame which we call the *Prickle-Pear*, or *Indian Fig*, having thick roundiſh Leaves that grow one out of another and full of ſharp prickles. Theſe Grubs in proceſs of time becoming Flies like our Lady-Birds, as above, and being come to full Maturity, (which muſt be found out by experience in collecting them at ſeveral ſeaſons) they Kill by making a great ſmother of ſome combuſtible matter, to Windward of the ſhrubs whereon the Inſects are feeding, (having before ſpread ſome Cloths all under the Plants) whereby all the Inſects being Smother'd and Kil'd, by ſhaking the Plants will tumble down upon the Cloths. Thus they are gathered in great quantities with little trouble. Then they ſpread them on the ſame cloaths in ſome bare ſandy place, or ſtone pavement, and expoſe them to the heat of the Sun, until they are dry, and their Bodies ſhrivel'd up, which being rub'd gently betwixt ones Hands, will crumble into Grains and the Wings ſeparate from them, which muſt be garbled out; others 'tis ſaid, do expoſe them to the Sun in broad and ſhallow Copper Baſons, wherein the reflection of the Sun will dry them ſooner. Theſe Plants called the *Indian* Fig, are eaſily and quickly propagated by putting a ſingle Leaf above half its depth into the Ground, which ſeldom fails to take Root and throw out other new Leaves at the top thereof, (of which Plant 'tis ſaid in *Barbadoes* impregnable Fences are made). Others ſay they may be raiſed from the Seed, or ſmall Grains which are to be found in the proper ſeaſon in the Fruit which is ſomething like a Fig, ariſing out of certain yellow Flowers or Bloſſoms that grow out at the tops of the uppermoſt Leaves, which Fruit is full of a Red Pulp, that when full ripe ſtains the Hands of them that touch it, like Mulberries, with a Purple or Sanguin Color, whereon, or on the Bloſſoms, ſome ſay the Inſects do feed; which happily may be the occaſion of that rich Tincture within their Bowels. It may be enquired likewiſe, whether thoſe Grains, which are the Seed of the Fruit, may not produce ſome Tincture as well as the dryed Inſects, or whether whilſt they are Maggots, or ſmall Grubs, being ordered and dryed as above, they may not ſhrivel up like Grains, and be as good as when they are become Flies with Wings,

The Gentleman to whom we are oblig'd for theſe Communications, at the ſame time propoſed the following Quæries concerning *Salt-Petre* and *Indico*, to which 'tis hop'd ſome curious and knowing Perſons may be prevailed with to furniſh proper Anſwers, which would be very grateful to the Royal Society.

1. *To enquire how the Salt-Petre is made in* India; *whether by the heat of the Sun or with Fire or both: what ſort of Earth the Lye whereof the Salt Petre is made is extracted from: how the ſaid proper Earth may be known, either by Colour or Taſte or otherwiſe; in what Latitude or Climate it moſt abounds: whether it be found moſt, nigh to Rivers or the Sea ſide or in Woods from the falling of the Leaves, and how deep in the Earth it is to be ſearch'd for.*
2. *To get a true Account of the whole Operation of* Indico *from* Jamaica, *or elſewhere, the managing of the Plants, and how raiſed, whether by Seed or otherwiſe, and to know the proper Seaſon for Sowing if rais'd by Seed, and what ſort of Soil is required for the ſame.*

Some Experiments and Obſervations made of the force of the preſſure of the Water in great Depths, made and communicated to the Royal Society, *by a Perſon of Honour.*

APril 8th. *ſt. v.* 1680. Being off of *Pantalaria* near *Sicily* in a Calm, I let down a Bottle 70 Fathom, ſtop'd with an excellent good tender Cork, well fitted, and bound down; and the Cork came up in the Bottle ¾ full of Salt Water: Whereupon making ſome Reflection on the ſoftneſs of the Cork, the Bottle was again fitted with an excellent good Cork, but of a woodineſs or hardneſs as ſome Corks are, with the which, being let down in like manner, the Cork continued in its place, but as it were bruiſed, and the Bottle as before, about ¾ full of Salt Water. Whereupon I took a good Ox Bladder, and bound it four-fold over the mouth of the Bottle without any Cork at all, only I put a piece of Leather to keep the Glaſs from cutting the Bladder, as it might do, having ſomewhat a ſharp mouth; and ſo order'd, it was let down as before, but taken up without any water, or the leaſt moiſture in it.

May 18, 1680. Being in a ſtark Calm ſome Leagues diſtant from the Coaſt of *South-Spain*, off the great Hills of *Granada*, in purſuance of the foregoing Experiment, we took a Bottle and clapt a Leather on the mouth of it, tying over that a ſingle part of a Bladder, the which we let down 75 Fathom, but it came up again intire; whereupon imagining that the Leather in great part had contributed to the reſiſtance the Bladder had made, being that the ſame was marked very much by the force of the preſſure againſt the mouth of the Bottle: We made a hole in the Leather about the bigneſs of a large Pea, and let the ſame again down 75 Fathom, but it came up perforated in the vacant place where the Leather had the hole in it, and almoſt full of water; we then bound over another part of Bladder ſingle, and let it down but 30 Fathoms, but it came up whole and intire; whereupon immediately we let it down 50 Fathom, but it came up broke and full of water. Then we again fitted the Bottle with the ſaid perforated piece of Leather and a double Bladder, and let it down 50 Fathom, but it again came up intire: So again immediately we let it down 75 Fathom, but then it came up broke and full of water; when the wind bringing the Ship into motion hindered our farther trials.

June 24, 1680. Being in 39¼ degrees of Latitude, and by the Ships account 150 Leagues Weſtward of *Portugal*, I cauſed a *Florence* Flask to be well ſtop'd with a Bladder over the mouth of it, and lower'd it down 30 Fathom, but it was taken up broke. Whereupon imagining that the roughneſs of the Leads halling ſo tender a Body ſo violently through the water, might be the breaking thereof, I caus'd another Flask in the like manner to be fitted, and cloſe by it I tied likewiſe another Flask, ſo as to be born with the mouth downwards, as were the other, but which was not ſtop'd; and theſe I caus'd to be taken up when they had been but 10 Fathom under water; and found them both entire, but the open Flask almoſt full of water; the which being emptied, were both let down again, and taken up at 20 Fathom, when the open Flask was entire, tho full of water, but the other broken to pieces.

Lumbricus Hydropicus;

OR

An Eſſay to prove that Hydatides *often met with in morbid Animal Bodies, are a Species of Worms, or Imperfect Animals. By that Learned and curious Anatomiſt* EDWARD TYSON, M. D. *and* R. Soc. S.

THE Title of this Eſſay, I doubt not will be ſome ſurpriſe to the Reader, and may prejudice his Judgment in what I am to offer; which indeed doth give me caution in it. But that I might not impoſe upon his Belief, or what I ſhall mention might not hinder his farther inquiry, 'tis only as an Eſſay. If truth, others Obſervations will confirm it; if otherwiſe, 'twill be a great ſatisfaction to be better inform'd.

By the opportunity given me of diſſecting a *Gazella*, or Antilope brought from *Aleppo*, I obſerved ſeveral *Hydatides* or *Filmes* filled with limpid Water, about the bigneſs of a Pigeons Egg and oval, which were faſtened to the *Omentum*, and ſome in the *Pelvis* between the Bladder of Urine and the *Rectum*. Upon this occaſion I was very deſirous of ſatisfying my ſelf as much as I could of ſome ſuſpicions I had of the like watery Bags,or *Hydatides* I had met with in other Animals, for from what I could then obſerve, I was apt to believe them to be a particular ſort of Inſect bred in animal Bodies, but ſo different from any obſerved out of them, that unleſs upon fuller and farther conſiderations, I durſt not truſt my own thoughts about them.

My preſent Reaſons of ſuſpecting them to be Inſects, or at leaſt the Embrioes or Eggs of them, are theſe,

Firſt, Becauſe I obſerved them included in an outward Membrane like a *Matrix*, ſo looſely, that by opening it with my Fingers or a Knife, the inward Bladder containing the *Lympha* or *Serum*, ſeemed no where to have any connexion or hold to it, but would very readily drop out, ſtill holding its Liquor without ſpilling any of it. Upon repeated Experiments of it in this, and other Animals, it gave me opportunity to think how it was poſſible this Humour could come into the inward Bladder without any cohæſion to the outward which involved it.

Secondly, Obſerving them farther by my naked Eye, I perceived that to this inward Bladder there was a Neck or white Body, more opake than the reſt of the Bladder, and protuberant from it: but ſo as I could obſerve an Orifice at the extream of it, which then to me ſeemed to be occaſioned by the retraction of ſome part of it inwards. By this I fanſied it might as by a Mouth, ſuck the *Serum* from the outward Membrane, and ſo ſupply its Bladder or Stomach.

Thirdly, But in this Thought I was farther encouraged by the aſſiſtance of my very good friend Mr. *Richard Waller*, whoſe preſence I deſired at the Diſſection, and by imparting to him my thoughts, that theſe *Hydatides* might be a peculiar ſort of Inſects bred in Animal Bodies; we were reſolved to ſatisfie our ſelves of the Notion, and having obſerved what I have before mentioned, we found that this Neck (upon approaching it to the Candle) did really move, and that it did protrude and then ſhorten it ſelf. But for a better ſatisfaction, I ſhall give the Figures made by his ingenious Hand; both Natural as they appear'd to the naked Eye, and what they were diſcover'd to be by the Microſcope.

Fig. 1. Repreſents one of theſe watery Bladders in its natural bigneſs incloſed in its outward Membrane or *Chorion*, its ſhape was almoſt round, only flatted as a drop of Quickſilver will be by lying upon a ſolid. (*a*) ſhews the Neck, ſeen through the Membrane, which in

Fig. 2. is more plainly repreſented, (the outward Membrane being taken off) but as appearing to the naked Eye; where we may obſerve an open Orifice at the Extream of it, and that it is made up of circular Rings or Inciſures; which in

Fig. 3. being viewed by a Microſcope, do more evidently diſcover themſelves: This part is granulated with an abundance of fine Eminences all over. The Orifice at the end ſeemes here to be occaſioned by drawing it ſelf inwards, and upon trial we found it ſo, for in

Fig. 4. Is repreſented the Neck of this Worm drawn out its whole length and magnified: Where way be obſerved the leſſening of the Rings, and its tending to a point at the end. And having opened it; within we found two ſmall ſtrings (*a a*) proceeding from the Neck and floating in the Liquor.

What theſe two Strings may be, is hard poſitively to aſſert: Leaving others to their own conjectures, I ſhall deliver mine; That this Worm by protruding its Neck, ſucks from the outward Membrane (which involves it, and is furniſhed with Blood-Veſſels,) the moiſture or nouriſhment which is conveyed by theſe two Strings or Pipes into the Stomach or Bladder, and from whence, as there is occaſion, it may be ſupplied for the nouriſhing the whole Body of the Worm again; for I am apt to believe this Bladder is but the Stomach of the Worm, which will appear leſs unreaſonable if we conſider in ſome Inſects how prodigiouſly large the Stomach is in proportion to the other parts of the Body; in a Leech you may obſerve not a ſingle but above Twenty Stomachs, emptying out of one into another, and running the whole length of the Body. And what *Malpighius* obſerves of the *Silk Worm*, that it would devour in one day as much as was the weight of its whole Body; a Leech will do far more at a Meal.

De Bombyce p. 40.

Some it may be will be more inclin'd to think that the whole is but an Egg or Embrio of another Inſect a forming, and that this Bladder is as it were the *Amnion*, and the outward Coat that includes it the *Chorion*. But could they perfect any ſuch diſcovery, I ſhould think ſo too. But formerly in Diſſecting a Rotten Sheep, wherein I found many of theſe *Hydatides*, and opening ſeveral of them, I could not obſerve but the ſame Structure exactly in all; and doubtleſs had it been otherwiſe, in ſo many, I could not but have met with ſome nearer to Perfection.

Theſe *Hydatides* therefore I cannot but think are a ſort of Worms or Inſects *ſui generis*, and becauſe they contain ſo much water in them, and are uſually to be met with in rotten Sheep which are *Hydropical*: I call them *Lumbrici Hydropici*; not that I think all thoſe *Ciſt's* to be met with in morbid Bodies are ſuch; for in ſome I have not obſerved this Neck and Structure of Parts, but only a tranſparent Bladder filled with a *Lympha*, and thoſe I take to be of another kind.

Thus in a Patient ſtill Living and enjoying her Health better than all her life time before; about Ten Years ago I cauſed her Right Side to be opened a little below her ſhort Ribs, whence iſſued out abundance of lympid Water, but what was moſt ſurpriſing, together with it, a great many *Hydatides*; that firſt and laſt, as we gueſſed, there might come out about 500 of theſe Bladders: moſt were entire and fill'd with limpid Water; of others that were too large for the Orifice, the *Filmes* were broke, but in none of them could I obſerve the Neck, tho I was inquiſitive to find it, which makes me think them to be different from our preſent ſubject.

As are likewiſe thoſe I have frequently met with in the *Ovaria* or Teſticles of Women who have died *Hydropical*, which I take to be only the Eggs contain'd there, which by an extravagant flux of Humours into them are often ſwelled, to that prodigious bigneſs, that I have taken ſometimes ſeveral Gallons of Liquor out of them.

And what is mentioned *Philoſ. Tranſact.* N°. 188. of thoſe Bladders of Water found in the Urine-Bladder, will come into the ſame number, having obſerved no Neck in any of them.

I ſhall only add, that theſe *Lumbrici Hydropici* I have always found hanging to the Membranous Parts, rather than included in the Body of any of the *Viſcera*, as to the *Omentum*, *Peritonæum*, or the outward Membranes that cover the Diaphragm, Stomach, Liver, Colon, or other Inteſtines.

And we may be leſs ſurpriſed at the odd Structure in this Worm; ſince what I have obſerved of the *Lumbricus Latus* (*Philoſoph. Tranſact.* N°. 146. *p.* 113.) and of the *Teres* (*Philoſ. Tranſact.* N°. 147. *p.* 153.) is as wonderful, tho in a different manner. And whoever has the curioſity of obſerving the Inwards of the vaſt Kingdom of Inſects, cannot want Subjects enough for exciting his admiration.

De Viſibili Conjunctione Inferiorum Planetarum cum *Sole*, Diſſertatio Aſtronomica, Authore E. Halley.

Mercurii Veneriſq; ſidera Solis diſcum ſubintrare, ac inſtar Macularum nigricantium in lucido ejus Orbe aliquando conſpici, tam ex verioris Aſtronomiæ principiis, quam ex indubitata Obſervantium fide, dudum compertum eſt. Qua vero lege, quibuſq; conditionibus, quantiſq; annorum intervallis hæc phænomena nobis ſpectanda præbentur, neſcio an aliquis ex Aſtronomis hodiernis rite definiverit: Certe nihil hac de re inter Typis mandata hucuſq; mihi viſum eſt: Quapropter non ingratum fore arbritratus, huic inquiſitioni ſerio operam dedi, ac diſſertatione hac rem maxime perplexam pauciſq; intellectam me plenius enucleaturum confido.

Has Planetarum horum Phaſeis ſemper in retrogradientium cum Sole conjunctionibus fieri, cum ſcilicet Sol Nodis eorum adeo vicinus ſit, ut Planetæ Soli juncti Latitudo Semidiametrum Solis non excedat, per ſe ſatis conſpicuum eſt; quo vero facilius limites ac conditiones harum Conjunctionum perveſtigem, cumq; calculi elementa omnino diverſi ſint, uterq; Planeta ſigillatim tractandus eſt: à Mercurio itaq; exordiamur.

Hujus Planetæ Nodum Aſcendentem, juxta nuperas & accuratas obſervationes, prope 15°. Tauri, ſeu potius ad 0^s. 15°.44′ à 1^a ✱ ♈, hoc noſtro ſeculo reperiri, pro comperto habemus. Deſcendentem vero oppoſitum ad 6°. 15^s. 44′ à 1^a ✱ ♈. Angulus autem quo Planum Orbitæ Mercurialis ad Eclipticam inclinatur ſatis bene ſe habet apud Keplerum, viz. 6°. 54′. Jam ex probatiſſimis Hypotheſibus conſtat Mercurii in Nodo

Aſcendente conſtituti diſtantiam à Sole eſſe partium 31365, *quarum media Solis diſtantia à Terra ſit* 100000; *dum vero Nodum alterum occupat, diſtantia iſta in iiſdem partibus menſurata ſit,* 45308. *Sol vero Nodo Aſcendenti oppoſitus diſtat à Terrâ eidem junctâ partium iſtarum* 98955: *ad Nodum vero alterum eadem intercapedo ſit* 101007, *atq; idcirco Mercurius Soli conjunctus ad Nodum Aſcend. diſtat à Terrâ partibus* 67591: *ad Nodum vero Deſcend. partibus* 55699. *Quæ cum inter ſe valde diſcrepent, ſeparatim etiam conſiderandæ veniunt Conjunctiones illæ, quæ ad diverſos Nodos fiunt, Calculi elementis compendii gratia Synopticè expoſitis.*

Conjungatur Mercurius Retrogradus cum *Sole* Centraliter ad Nodum Aſcendentem, Menſe *Octobri*; ac ex prædictis Hypotheſibus habebitur.

	s	°	'	"
Longitudo Solis à prima Stella Arietis	6	15	44	00
Longitudo Mercurii ex Sole viſi	0	15	44	00
Diſtantia Mercurii à Sole, partium	31365			
Diſtantia Mercurii à Terra	67591			
Angulus Inclinationis Orbitæ Mercurii		6	54	00
Motus 6 Horar. Mercurii ex Sole Viſi		1	30	58
Motus Solis in iiſdem ſex horis			15	5
Hinc Motus Mercurii à Sole; ſex horis		1	15	53
Et Motus ejus à Sole ex Terra viſo, 6 Horis		0	35	12
Et Angulus viæ Mercurii intra Solem viſæ cum Ecliptica		8	15	00
Hinc motus Mercurii in orbitâ ſuâ viſibili 6 Horis			35	40
Deinde motus Mercurii in Anno ſiderio ultra quatuor revolutiones	1	24	45	8
In Annis tredecim itaq;	11	21	46	44
Deſunt itaq; ad Revolutiones 54 integras	0	8	13	16

Quod

		d	h	'
Quod ſpatium percurrit Mercurius in		2	00	13
Quibus promovetur Solis locus; ac ☿ in Nodo ſitus tantundem diſtat à conjunctione Terræ		2°.	1'	00"
At arcus iſte ex Terrâ ſpectatus fit		0	56	10
Unde ex dato Angulo viæ viſæ 8°. 15' provenit baſis, ſive diſtantia à conjunctione viſibili		0	55	34
Qui arcus percurritur à Mercurio juxta Horariam datam horis			9_h	21'
Excedunt vero 13 Anni Siderii totidem Julianos cum Intercalationibus tribus, horis			8^h	00'
Itaque Mercurius revertitur ad Solem poſt Annos Julianos 13 atq; inſuper		2_d	17^h	34'
Vel cum quatuor intercalationibus, ſi præcedens annus ſit tertius à Biſſext.		1	17	34
Ex arcu vero 56', 10". & angulo dato, fit perpendicularis ſive proxima diſtantia ☿ii à Sole		0	8'	3"
Itaque ☿ poſt 13 annos intra Solem conſpicuus 8'. 3" Borealius incedit				
Pari Argumento in 46 annis ſideriis movetur ☿	11^s	28°	36'	8"
Deſunt itaq; ad revolutiones 191 integras	0	1	23	52
Hoc eſt in tempore			8_h	12'
Quo promovetur Sol		0°	20'	41"
Hic arcus è Terra viſus fit		0	9	36
Baſis vero ei competens		0	9	30
Tempus vero quo Mercurius baſin percurrit fit		1^h	36'	00
Excedunt vero 46 Anni Siderii totidem Julianos cum 11 Intercalationibus, horis		19	3	00
Ac Mercurius revertitur ad Solem poſt 46 annos Julianos atq; inſuper		1^d	4^h	51'
Vel cum duodecim intercalationibus, ut fit cum annus præcedens ſit ſecundus vel tertius à Biſſextili		0	4^h	51'
Perpendicularis vero qu Mercurius in Boream provehitur fit		0°	1'	22"

		h	'
Periodus vero maxime accurata Mercurii ad Solem abſolvitur annis ſideriis 263 atque inſuper		1	11 ½
Hi vero ſiderii ſuperant totidem Julianos cum 66 intercalationibus, horis		10	20
Unde poſt 263 Annos Julianos, Mercurius ad Solem revolvitur, tardius vero		11	31 ½
Quod ſi præcedens annus Biſſextilis fuerit addantur	1d	11	31 ½

Poſt hoc demum intervallum Borealius incedit non niſi decem minutis ſecundis.

Ceteræ vero periodi latiores ex jam inventis facili negotio eruuntur, ſuntq; vel Sex vel Septem Annorum.

Quæ ſeptem annis abſolvitur, Mercurium deprimit verſus Auſtrum 22′. 47″, ac ſeptem dies integros minus 9 minutis citius provenit, ſi duæ fuerint intercalationes. At cum una intercalatione, cum ſcil: annus prior Biſſextilis ſit, 6 dies ſubducendi ſunt, additis tantum 9 minutis, ut prius.

Rarius vero poſt ſex Annos in Solis diſco conſpicitur iterum vagus ille Planeta, qui exacta hac periodo 30′. 50″ Borealius tranſit; idq; tardius 8d. 17h. 25′, ſi annus præcedens ſit ſecundus vel tertius à Biſſextili; aliter 9d. 17h. 25′ addendi ſunt.

Pariter ſi fiat Conjunctio ad Nodum Deſcendentem Menſe *Aprili.*

	S	°	'	"
Longitudo Solis à prima ſtella Arietis	0	15	44	00
Mercurii Longitudo ex Sole viſa	6	15	44	00
Diſtantia planetæ à Sole ut prius		45308		
Diſtantia ejus à Terra		55699		
Motus Mercurii è Sole viſus Sex horis		0	43	21
Motus Solis in eodem tempore		0	14	29
Motus Mercurii à Sole		0	28	52
Hinc angulus Viæ Viſæ Mercurii intra Solis diſcum cum Ecliptica fit		10	18	00
Motus vero viſus à Terra in ſex horis		0	23	52

Unde ſequendo methodum calculi præcedentis, evincitur Mercurium poſt 13 *annos atque in ſuper* 3d. 7h. 37′. *ad Solis conjunctionem revolvi; quod ſi præcedens Annus fuerit tertius à Biſſextili, tunc addendi ſunt* 2d. 7h. 37′. *tantum: ac tum Mercurius* 16′. 55″. *Auſtralius incedere reperietur. Poſt* 46 *vero annos, cum* 12 *intercalationibus addantur* 0d. 7h. 14′. *& habebitur Mercurius Soli conjunctus in tramite Auſtraliore* 2′. 53″. *ſi vero annus prior Biſſextilis fuerit, vel ab eo primus, addendus eſt* 1d. 7h. 14′. *ut habeatur accurate Synodus. Similiter poſt* 263 *annos, quibus Mercurius in Auſtrum deflectitur* 0′. 22″. *addendus eſt vel* 1d. 11h. 49′, *vel* 11h. 49′. *juxta legem in priori caſu præſcriptam.*

At annis ſex vel ſeptem ob viciniam Terræ ac planetæ, atque idcirco ob ampliatos arcus, ad hunc Nodum non revertitur ad Solem, ut intra diſcum appareat. Poſt Annos autem 33 *Solem tranſit viâ magis Boreali* 14′. 2″. *ac habetur momentum conjunctionis ſubducendo à prioris tempore* 3d. 0h. 23′. *ſi fuerit in anno tertio à Biſſextili; aliter ſubduc* 2d. 0h. 23′. *tantum.*

His inventis facile erit continuare calculum pro omnibus hiſce conjunctionibus Mercurii cum Sole, idque cum ſummâ certitudine, ac ſine ullâ hæſitatione an omnes poſſibiles habeantur, necne: Sola Additione obtinentur momenta conjunctionum ac diſtantiæ planeta à Centro Solis, unde etiam ope Tabellæ depromuntur durationes harum, ut ita dicam, Eclipſium: ut nihil ſit quod in hac re deſiderari videatur.

Epochas vero quod ſpectat, eæ tutius Obſervatorum induſtria comparantur, quam Calculi cujuſvis Subtilitate: adeoque elegimus in primo caſu, notabilem illum tranſitum Mercurii quem ipſe in Inſula Sanctæ Helenæ *perfectiſſime obſervavi, Octob.* 28. *Anno* 1677, *St. Vet. & cujus medium ex initio & fine determinavi in prædicta Inſula quidem* 0h. 4′. *P. M.* Londini *vero* 0h. 28′. *P. M. Semita vero qua incedere viſus eſt Planeta* 4′. 40″. *Borealior erat Solis centro. In altero caſu, viz. cum Mercurius Soli conjungitur*

Menſe Aprili, Ex Cl. Hevelii Mercurio in Sole viſo *pag.* 72. 75. *Epocham deſumere placuit ; nempe quod Apr.* 23. *Anno* 1661. *St. Vet.* 6h. 8'. *P. M,* Gedani, *hoc eſt* 4h. 52'. Londini, *Mercurius Solis centro proximus apparuit, utpote in medio tranſitu, ſimulque diſtabat ab eodem centro* 4' 27". *ad Boream. Hinc juxta præcepta præmiſſa, omnes ordine viſibiles conjunctiones Mercurii cum Sole ſimul exhibere, exigui laboris opus erit : ac in exemplum quod cuivis in poſterum imitari licet, accipe hujus ſeculi ab invento Teleſcopio quotquot uſquam apparuere hujuſmodi Phænomena vel quæ etiam inſequentis ſeculi poſteris apparitura ſunt.*

Series momentorum quibus Mercurius Soli conjunctus intra diſcum ejus conſpicitur, per præſens & futurum ſeculum, cum diſtantiis Planeta à Solis centro.

APRILI.

Ann.	Temp. Conj.			Diſt. à centr. ☉		
	d.	h.	'	'	"	
1615	22	21	38**	7	20	B
1628	25	5	15*	9	35	A
1661	23	4	52*	4	27	B
1674	26	12	29	12	28	A
1707	24	12	6	1	34	B
1720	26	19	43*	15	21	A
1740	21	11	43	15	36	B
1753	24	19	20*	1	19	A
1786	22	18	57*	12	43	B
1799	26	2	34**	4	12	A

OCTOBRI.

Ann.	Temp. Conj.			Diſt. à centr. ☉.		
	d.	h.	′	′	″	
1605	22	8	29	12	48	A
1618	25	2	3*	4	45	A
1631	27	19	37*	3	18	B
1644	30	13	11	11	21	B
1651	23	13	20	11	26	A
1664	25	6	54*	3	23	A
1677	28	0	28**	4	40	B
1690	30	18	2*	12	43	B
1697	23	18	11*	10	4	A
1710	26	11	45	2	1	A
1723	29	5	19*	6	2	B
1730	22	5	28	16	45	A
1736	30	22	53**	14	5	B
1743	24	23	2**	8	42	A
1756	26	16	36	0	39	A
1769	29	10	10	7	24	B
1776	22	10	19	15	23	A
1782	Nov. 1	3	44*	15	27	B
1789	25	3	53*	7	20	A

Tranſitus qui ſigno * notantur, Londini ex parte viſibiles ſunt, qui vero ſigno **, toti conſpici poſſunt.

Notandum vero eſt Solis Diametrum ad Nodum ☿$^{\text{ii}}$ *Aſcendentem Menſe* Octobri *occupare* 32′. 34″ *atq; adeo maximam durationem centralis tranſitus eſſe* 5^{h}. 29′ : *Menſe vero* Aprili *Diameter Solis fit* 31′. 54″ ; *unde ob tardiorem Planetæ motum oritur duratio maxima* 8^{h}. 1′. *Quod ſi obliquè incidat Mercurius, durationes hæ breviores redduntur pro ratione diſtantiæ à centro Solis: Quoq; perfectior calculus hic reddatur, ſequentes Tabellas adjunxi quibus exhibentur dimidiatæ durationes harum Eclipſium ad ſingula minuta diſtantiæ viſæ à centro Solis; quæ additæ ac ſublatæ à conjunctionis momento in priori Tabula invento, initium ac finem totius Phænomeni deſignant.*

Octobri.

Min. Diſt. '	Semi-durat. H.	'
0	2	44½
1	2	44
2	2	43
3	2	41½
4	2	39½
5	2	36½
6	2	33
7	2	28½
8	2	23
9	2	17
10	2	10
11	2	1
12	1	51
13	1	39
14	1	
15	1	24
15½	0	50
16	0	30

Aprili.

Min. Diſt. '	Semi-durat. "	'
0	4	0½
1	4	0
2	3	58½
3	3	56
4	3	53
5	3	48½
6	3	43
7	3	36
8	3	28
9	3	18 $\frac{2}{1}$
10	3	7
11	2	54
12	2	38
13	2	19
14	1	55
15	1	21½
15½	0	56

Obſervationes omnes hucuſq; habitas rite repræſentant hi numeri, nec eſt quod dubitem de futuris, cum ex omnibus Planetis Mercurius Soli proximus ejus centro adeo vicinus ſit, ut aliorum centrorum interventu minime cieatur, nec deviationibus illis quæ à cæterorum ſyſtemate oriuntur quibuſq; Superiores præſertim Saturnus obnoxii ſunt, quod ſentiri poſſit interturbetur.

Parallaxes conſultò omiſi, ut perexiguas, quæq; locis diverſis diverſæ obvenientes generaliori calculo immiſceri non debent; quodq; etiam quantæ ſint non ſatis adhuc conſtat, ſed potius ex hujuſmodi Obſervatis tutiſſime derivari poſſint: Diametri etiam Mercurii rationem non habui, quia ſupra fidem parvus per *paucula ſolum minuta limbo adhærere videtur. Ex obſervatione accuratiſſimâ deprehendi vix duo minuta elapſa dum totus è Sole egrederetur* Octob. 28^{vo}. 1677, *unde concluſi Diametrum ejus* 0′. 11″, *ac juxta rationem diſtantiarum à Terra ad Nodum alterum eſſe,* 0′. 13″ $\frac{1}{2}$ *fere, adeoq; tunc* 3′ $\frac{1}{2}$ *temporis minuta inſumi, dum totus planeta Solis limbum directe pervadit : Oblique vero tranſiens paulo diutius hæret, ſecundum ac Secantes angulorum incidentiæ augentur. Æquationes etiam Temporis haud opus eſt ut æſtimemus, quia per plures dies hinc inde in utroq; menſe conſtantes ac quaſi invariatæ perſiſtunt.*

De Viſibili Veneris cum *Sole* Conjunctione.

Venus quamvis ſyderum omnium ſpecioſiſſima, more ſexus ſui, ſine mutuato cultu ac ſplendore aſſcititio in conſpectum prodire veretur : Hoc etenim ſpectaculum inter Aſtronomica longe nobiliſſimum, inſtar Ludorum ſecularium, integri ſeculi Mortalibus invident motuum arctæ Leges. Unico vero hoc Obſervato ſumma cum certitudine diſtantiam Solis à Terra determinari poſſe, quæ ob Parallaxin alias prorſus inſenſibilem vagis terminis hucuſq; definita eſt, poſthac declarabitur. Periodos vero quod attinet, illæ non adeo accurate ac Mercuriales deſcribi poſſunt, cum Venus ſemel tantum ob Orbe condito, idq; ab Horroxio *noſtro, intra Solis diſcum deprehenſa ſit : Correctis autem motibus quantum per rudiores Veterum obſervationes licet, accipe jam ſummam Calculi.*

	S	°	′	″
Longitudo Nodi *Aſcendentis Veneris a prima Stella Arietis*	1	15	16	00
Sol itaq; ei jungitur in puncto oppoſito, hoc eſt, per hæc ſecula, circa finem Novembris	7	15	16	00
Diſtantia Veneris à Sole partium	71997			
Diſtantia Veneris à Terra	26438			
Inclinatio Orbitæ Veneris ad Eclipticam	3°. 23′			

	s	°	'	"
Motus Veneris in Octo Annis ſydereis, ſupra tredecim Revolutiones	0	1	30	28½
Motus Veneris in 235 *Annis ſydereis ſupra* 381 *Revolutiones*	11	29	17	39
Motus Veneris in 243 *Annis ſydereis ſuprà* 395 *Revolutiones*	0	0	48	8

Ex his principiis, inito calculo juxta methodum in Mercurio expoſitam, proveniunt intervalla temporum ac diſtantiarum ut ſequitur.

Poſt octo annos Venus revolvitur ad Solem, ſcilicet ſublatis à prioris tranſitus momento $2^{d}. 10^{h}. 52'\frac{1}{2}$. *Incedit vero Planeta ſemitâ* 24′. 41″. *priore magis Auſtrali.*

Poſt annos 235, *additis* $2^{d}. 10^{h}. 9'$, *Venus iterum Solem ingredi poteſt, ſed viâ* 11′. 33″ *Borealiori: Quod ſi præcedens annus Biſſextilis fuerit* $3^{d}. 10^{h}. 9'$ *addendi ſunt.*

Poſt annos 243, *Venus etiam Solem tranſire poteſt, auferendo tantum* $0^{h}. 43'$ *a prioris tempore, Auſtralius vero incedit* 13′. 8″ : *Quod ſi præcedens annus Biſſextilis fuerit, adde* $23^{h}. 17'$.

Et in omnibus his appulſibus Veneris ad Solem, Menſe Novembri, *Angulus viæ viſæ Veneris cum Ecliptica ſit.* 9°. 5′, *ac motus ejus Horarius intra Solem* 4′. 7″; *cumq; ſemidiameter Solis ſit* 16′. 21″, *provenit maxima duratio tranſitus centri Veneris* $7^{h}. 56''$.

Deinde conjungantur Sol & Venus ad Nodum Deſcendentem Menſe Maio; *ac juxta numeros eoſdem ſupputantur intervalla eadem. Poſt octo Annos auferendi ſunt* $2^{d}. 6^{h}. 55''$, *ac Venus orbitâ* 19′. 58″ *Borealiori pertranſibit.*

Poſt annos 235 *adde* $2^{d}. 8^{h}. 18'$, *vel ſi prior annus Biſſextilis fuerit,* $3^{d}. 8^{h}. 18'$ *& habebis Venerem Auſtraliorem* 9′. 21″.

Deniq; poſt 243 *annos; adde* $0^{d}. 1^{h}. 23'$; *vel ſi prior annus Biſſextilis fuerit* $1^{d}. 1^{h}. 23'$ *& reperietur Venus iterum Soli conjuncta ſed in tramite* 10′. 37″ *magis Boreali.*

In omni ad hunc Nodum tranſitu intra Solem, angulus viæ viſæ Veneris cum Ecliptica ſit 8°. 28; *ac Horarius ejus motus* 4′. 00″; *ac Solis ſemidiametro ſubtendente* 15′. 51″, *provenit duratio maxima centralis tranſitus etiam* $7^{h}. 56'$; *præciſe eadem ac ad Nodum alterum.*

Quoad Epochas: Ex ingreſſu quem ſolum vidit Horroxius in Sole jamjam occaſuro, concluditur, Venerem Soli junctam fuiſſe Londini 1639. Novemb. 24. 6h. 37′. *ſed verſus auſtrum inceſſiſſe* 8′. 30″. *Menſe* Maio *vero à nemine Mortalium hucuſque intra Solem viſa eſt, ſed ex numeris meis quos non multum à cœlo abluſuros confido, conſtat Venerem proximâ vice Solem ſubituram An.* 1761. *Maii* 25d. 17h.55′, *mediâ ſcil. Eclipſi, ac tunc diſtare à centro ejus verſus Auſtrum* 4′. 15″.

Hinc & ex præmiſſis revolutionibus facili negotio omnia hujus generis Phænomena per Millennium integrum computavi, ut in ſequenti Tabella exhibentur.

Menſe Novembri.

Ann.	Temp. Conj.			Diſt. à Cent.		
	d.	h.	′	′	″	
918	20	21	53	6	12	B
1161	20	21	10	6	55½	A
1396	23	7	20	4	38	B
1631	26	17	29	16	11	B
1639	24	6	37	8	30	A
1874	26	16	46	3	3	B
2109	29	2	56	14	36	B
2117	26	16	3	10	5	A

Menſe Maio.

Ann.	d.	h.	′	′	″	
1048	24	13	45	3	50	B
1283	23	8	14	5	31	A
1291	25	15	9	14	27	B
1518	25	16	32	14	52	A
1526	23	9	37	5	6	B
1761	25	17	55	4	15	A
1769	23	11	00	15	43	B
1996	28	02	13	13	36	A
2004	25	19	18	6	22	B

Durationes harum Veneriarum Eclipſium quod attinet, reſpectu centri eodem modo ſupputari poſſunt ac Mercuriales; ſed cum Diameter Veneris ſatis ampla ſit, cumq; Parallaxes etiam differentiam valde notabilem quoad tempus ingerere poſſint, calculus peculiaris pro locis ſingulis neceſſario ſubeundus eſt.

Veneris autem Diameter tanta eſt, ut dum limbo Solis adhæret, ferme 20 *temporis minuta præterfluunt; cum ſcil: Solem directe aggreditur; oblique vero incidens, etiam diutius limbo immoratur. Occupat autem diameter iſta, juxta Horroxii obſervationem* 1'. 18", *dum ad Nodum Aſcend: Soli jungitur; ac* 1'. 12" *ad Nodum alterum. Præcipuus autem harum conjunctionum uſus eſt, Solis à Terra diſtantiam ſive parallaxin ejus accurate determinare, quam quidem fruſtra variis methodis tentaverunt Aſtronomi; dum inſtrumenta quantumvis ſubtilia angulorum quæſitorum minutiæ facile eludunt. At in obſervando Veneris in Solem ingreſſu & ab eodem egreſſu, ſpatium temporis inter momenta contactuum internorum, ad ipſum temporis minutum ſecundum, hoc eſt, ad* $\frac{1}{15}$ *minuti ſecundi ſive* $4'''$ *arcus obſervati, ope mediocris Teleſcopii, & Horologii Oſcillatorii per* 6 *vel* 8 *horas accurate ſibi conſtantis, obtineri poteſt. Ex duabus autem talibus obſervationibus in Locis idoneis debite inſtitutis, intra quingenteſimam partem certò concludi Solis diſtantiam proximâ occaſione commonſtrabo.*

Ne quid obſcuri Lectoribus Aſtronomice minus doctis videretur, Schemata pro utriuſq; Planetæ tranſitu delineavi, Fig. 12, 13. *quibus rem oculis ſubjicere conatus ſum.*

Some Obſervations made on the Spawn of Frogs, *and of the production of* Todpoles *therein, by the Learned and Curious* Richard Waller, *Eſq*; Reg. S. Secret.

ABout the twelfth of *March* 1689. I took ſome Frog-Spawn out of a Ditch, which I ſuppoſe might have been Spawned about 14 days, and kept it in a Gally-Pot of Water, which I ſhifted every day or two, and kept them in a Window where the Sun ſhined ſome part of the Day.

At the firſt they appeared as Fig. 5. being a round black Globule encompaſt with a clear Liquor as I afterwards found, and a Membrane encompaſſing that Liquor, and that encompaſſed with a larger Sphere of a more Mucous Liquor.

The ſecond day that I kept them they appeared as Fig. 6. The third day as Fig. 6. The fourth day as Fig. 7.

And about the ſixth day ſeveral of them were looſed from their Eggs, and on the 7th. and 8th. more of them: when they appeared of the ſhape of Fig. 8. which in Fig. 9. is repreſented bigger than the Life; that the poſture they lay in may be ſeen the better.

On the 7th. and 8th. days upon pricking of them with the point of a Needle they would contract themſelves; and ſome of them on the 8th. day would of themſelves bend their bodies, but not move out of their place, which was the bottom of the Pot they were kept in.

When they firſt got through their Egg (which I ſuppoſe they did by eating their way) they hung faſt upon the outſide of it, by that part which I afterwards found to be their Mouth, and when looſed from their hold they ſunk to the bottom of the Water, and could not riſe again.

On the 9th. day they were not viſibly increaſed in bulk, only they moved themſelves more freely at the bottom of the Veſſel.

At about 14 days end they appeared as Fig. 10. at which time they ſwam about in the Water by moving their Tails, as Fig. 11. and ſome Rudiments of their fore Legs were viſible, which looked forked and like a ſprig of a Plant.

At three weeks end their Mouths were to be ſeen, which they opened and ſhut, and emitted *Fæces* from the other end.

At a months end the Eyes were to be diſcerned, at which time they would ſwim near the top of the Water, and opening their Mouths let out a ſmall bubble of Air, and I ſuppoſe take in freſh.

The Liquor which was contained in the innermoſt Membrane, was more tranſparent than the other, which was a Mucous Liquor, and like the White of an Egg; the whole was a little heavier *in Specie* than Water, for a ſingle Egg ſunk when looſed from the reſt, but when they were faſtened a great many together, they ſwam, every three Eggs leaving a little ſpace, which being filled with Air made them ſpecifically lighter than common Water.

An Account of a Ruminating Man *lately living at* Briſtol, *given in to the* Royal Society, *by the Experienced and Learned* Frederick Slare, M. D. & Reg. Soc. S.

HAving heard of a Perſon at *Briſtol* that did Eat his Meat twice, I was willing to know whether he had really the Faculty of Ruminating, and did preſently (for my information) ſend a Letter to a very intelligent Perſon in that Town, with a ſet of Queſtions; requeſting it of him that he would procure me ſuch Anſwers to them as he could beſt obtain.

Queſtion I. *How long after Meals does he begin to Chew his Meat over again?*

Anſw. Within a quarter of an hour if he drink with it; if not, ſomething longer.

Queſt. II. *How long does his Chewing laſt after a full Meal?*

Anſw. About an hour and half. If he go to Bed preſently after Meals he cannot Sleep till the uſual Time of Chewing be over.

Queſt. III. *What Taſt has the Victuals upon the return?*

Anſw. Somewhat more pleaſant than at firſt.

Queſt. IV. *What colour does it return of? Whether white and milky, or how?*

Anſw. Bread and Meat, and Cheeſe and Drink, does ſeem to me to return much of ſuch Colour as they would be of, if they were mixed together in a Mortar.

Queſt. V. *Whether this be a late accident?*

Anſw. He was always ſo ſince he can remember.

Queſt. VI. *What is his Age?*

Anſw. About twenty.

Queſt. VII. *Whether any of his Relations did ſo?*

Anſw. His Father does ſo ſome times, and in ſmall Quantities, but nothing like this.

Queſt. VIII. *Whether he has not been ſick ſometimes, and whether that Faculty continues then or no?*

Anſw. If that leave him it ſignifies ſickneſs, and he is never well till it return.

Queſt. IX. *How he was Nurſed, and whether he did Suck?*

Anſw. His Mother is out of Town, we do not know any thing to the contrary but that ſhe gave him Suck.

Queſt. X. *Whether he was ever a Shepherd? Or how bred up?*

Anſw. Formerly in the Mines, but now is a Day-Labourer.

Queſt. XI. *Whether he Chews Liquids, that is, whether Broath or Spoon-Meat returns to his Mouth as ſollid Food does?*

Anſw. All one as with dryer Meat.

Queſt. XII. *Whether he finds any Load extraordinary in his Stomach before Rumination; and what other thing very remarkable you meet with, pray inform?*

Anſw. The Victuals does lye heavy in the lower part of his Throat, as it ſeems to him, until it has paſſed the ſecond Chewing, afterwards it paſſes clean away. This he always obſerves, That if he Eats of variety of Things, that which paſſes down firſt comes up firſt again to be Chewed.

I received an account of ſuch a Perſon at *Briſtol* by Mr. *Mellin*, who ſaw this Perſon, but did not ſatisfie any of theſe Queries: for this Reaſon I ſent them to Mr. *Day*, at that time Mayor of *Briſtol*, who has made enquiry into theſe Particulars, and with his own hand ſent me their Anſwers.

Hiſtory is very ſparing as to many Inſtances of this kind: *Fabricius ab Aqua pendente* is (I think) the firſt that mentions one, being a Nobleman of *Padua* that Ruminated in his days, whom he had the luck to outlive, and the leave to Diſſect; and what is very ſtrange, he found only one large but very Rugous Ventricle. He alſo notes a Monk of that place to have had the ſame Faculty. *Sennertus* takes alſo notice of one; and ſo does *Salmuth:* as alſo *Velſhius*, who names one *Damy* a *Welchman* that lived in *London*, but of theſe they give no Particulars. *Ludovicus*, a *Franckfort* Phyſitian, who lately lived and Practiſed there, deſcribes a Perſon that to him ſeemed to Ruminate, but this ſort of Rumination ſeemed rather a Diſeaſe, for this Man did it with averſion, he rather diſgorged than Ruminated. Of this kind I have known ſeveral in *London* that do not fail to throw up an ill taſted and bitter Maſs, half an hour or an hour after feeding, and that to their great diſguſt: but in true Rumination it returns pleaſant, and they Chew it the ſecond time with delight. *Pyerus*, who has written at large and very ingeniouſly about Rumination, found two Perſons in his Country that were alive when he writ that Book, and had been taken notice of to Ruminate. They were very booriſh and fooliſh Perſons, that lived only amongſt the Beaſts; and he fancies that by frequent Converſation with Calves and Sheep they had learnt to imitate them. As to the Caſe we have mentioned from *Briſtol*, this Perſon is of mean Parents, but of tollerable Senſe and Reaſon.

A Letter from that incomparable Botaniſt Mr. John Ray, *giving an account of the* Phytographia *of* Leonard Plukenet, M. D. *Lately publiſhed.* Lond. fol. 1691.

SIR,

IN compliance with your deſires I have ſent you a ſhort Account of Dr. *Plukenets Phytographia*, not ſuch an one as the Work deſerves, but as I am able to draw up: wherein if you find not ſatisfaction blame your own Judgment for thinking me able to give it.

The Learned and Ingenious Author of theſe Tables hath therein exhibited to the publick view the Figures and Titles of many hundred Plants; the moſt part of them, as yet neither deſcribed nor figured, ſome deſcribed but not figured, others though already figured, yet not well and exactly. Now a good Figure having this advantage of a verbal Deſcription, that it conveys ſpeedily to the Mind, with eaſe and pleaſure, a clearer and truer *Idea* of the thing delineated, than the Underſtanding can with much Labour, and in a long time form to it ſelf from a Deſcription, be it never ſo exact: the pains taken, and coſt beſtowed in deſigning and engraving ſuch Plants as have already been only deſcribed, or if figured, but lamely and imperfectly, muſt be acknowledged to have been to very good purpoſe, and to merit the thanks of thoſe who ſhall be aſſiſted and eaſed thereby, that is the greateſt part of Herbariſts, to whom a Deſcription without a Figure ſignifies little. The new and *non-deſcript Species* may give entertainment and diverſion to thoſe of the higheſt form in *Botanics*, who will here meet with many Plants they have not before ſeen, or it may be heard of. As for the Sculps they recommend themſelves to the peruſal of all ſorts, as well for their Beauty and Elegancy, as for their exact ſimilitude to the Vegetables they were taken from or are intended to repreſent; which are the two only qualities requiſite to the perfection of a Cut.

The Titles ſubjoined to each Table may ſupply the place of Deſcriptions, as conteining certain Characteriſtic Notes, ſufficient to diſtinguiſh the *Species* to which they belong from any others whatſoever: ſo that they alone without any *Icon*, if diligently heeded and attended to, might ſerve to lead a Man into a certain knowledge of the Plants.

In this Work the Reader will find many miſtakes rectified, and obſcurities cleared up, which I ſhall not ſtand to enumerate; many *Deſiderata* are ſupplied, of which I ſhall inſtance in ſome few Particulars.

The Figure of that ſort of *Artemiſia*, of which the *Chineſe* make their *Moxa*, ſo famous for curing the Gout by burning.

Of the Root *Genſing* or *Ninzin* and its Plant, growing in the Kingdom of *Corea*, ſo much Celebrated in *China* and *Japan* for a *Panacea*.

Of the *Virginian Polyrrhizos* or Snakeweed, ſo much talked of for the Cure of the Rattle Snake. This hath been already figured, but not exactly.

Of the Tree whoſe Bark is well known by the name of *Cortex Winteranus*.

Add to theſe the Figures of that rare *Virginian* Hartstongue that propagates it ſelf by the tip of the Leaf turning downwards, and when it touches the Ground taking Root; from whence ſprings up a young Plant, which at laſt is of its own accord as it were weaned and ſeparated from its Mother, and maintains it ſelf by its own Root.

Of a ſort of Kidney-Bean from *Mevis* Iſland, which they call the Turnep Tree, having an eſculent Root.

Of two ſorts of Kidney-Beans, which are not trifoliate, but ſingle-leaved.

Of the top and Flowers of that Plant which *Lobel* inſcribes *Verbaſcum Sylveſtre Salvifolium exoticum folio rotundiore* erroneouſly, giving only the Figure of the Leaves and lower part of it: and *Parkinſon* I know not how deceiving himſelf and impoſing upon others, makes a kind of *Ciſtus*; whereas it appears to be a ſort of *Salvia fruticoſa*. For the reſt I refer the Reader to the Work it ſelf.

JOHN RAY.

ERRATA.

Pag. 518. l. 19. r. 1^h. $24'$. l. 20. r. 1^h. $4'$.

FINIS.

Numb. 194.

PHILOSOPHICAL TRANSACTIONS.

For the Months of *July*, *Auguſt* and *September*, 1691.

The CONTENTS.

1. *THE Method the* Indians *in* Virginia *and* Carolina *uſe to dreſs* Buck *and* Doe-Skins; *as it was communicated to the* Royal Society, *by the Honourable Sir* Robert Southwell *Knt. Their Preſident.* (2.) Obſervationes Ponderis *Teſtudinis* terreſtris, cum in Autumno Terram ſubiret, cum ejuſdem ex Terrâ Verno tempore exeuntis pondere comparati, per plures annos repetitæ; Experimento Celeberrimi Domini D. *Georgii Ent*, Equitis & M. D. & à Doctiſſimo Domino D. *Rob. Pitt.* M. D. & R. S. S. communicatæ. (3.) Emendationes & Notæ in tria Loca vitioſè edita in Textu vulgato Naturalis Hiſtoriæ. *C. Plinii*, per *E. Halley.* (4.) *An Account of the Meaſure of the Thickneſs of* Gold *upon* Gilt-Wire, *together with a Demonſtration of the exceeding Minuteneſs of the Atoms or conſtituent Particles of* Gold: *as it was Read before the* Royal Society, *by* E. Halley. (5.) Obſervationes aliquot rariores de Morboſo *Liene*, à ſpectatiſſimo Domino D. *Nehemia Grew*, M. D. ac R. S. Socio, cum eadem Societate communicatæ. (6.) *An Account of a Book,* Oſteologia Nova, *or ſome New Obſervations of the* Bones, *&c. Communicated to the Royal Society in ſeveral Diſcourſes read at their Meetings, By the Learned and Accurate Author* Clopton Havers, M. D. *and* R. S. Soc. Lond. 1691, Octavo, *for* Sam. Smith.

The Method the Indians *in* Virginia *and* Carolina *uſe to Dreſs* Buck *and* Doe-Skins; *as it was communicated to the Royal Society by the Honourable Sir* Robert Southwell, *Knt. their Preſident.*

THE *Pelt* being taken off is firſt ſtreined by Lines, or otherwiſe, moſt like the Clothiers Racks, but for no other purpoſe but to dry them.

The *Brains* of the Deer, whether *Buck* or *Doe*, is taken out and meſled, and dawbed on Moſs or dryed Graſs, and then dryed in the Sun, or by a Fire to preſerve them.

When the Hunting time is over, the Women dreſs the Skins; firſt, by putting them in a Pond, or Hole of Water, to ſoak them well. Then they with an old Knife fixed in a Cleft-Stick, force off the Hair, whilſt they remain wet. The Hair being taken or forced off, they put as many Skins as they have made ſo ready, into a Kettle or Earthen Pot, and a proportion of the Deers Brains, before ſpoken of, into the Kettle with the Skins; and then put them over a Fire till they are more than Blood-warm; which will make them ladder and ſcour perfectly clean; which done, they with ſmall ſticks wreſt and twiſt each Skin as long as they find any Wet to drop from them, letting them remain ſo wreſted ſome Hours; and then they untwiſt each Skin, and put them into a ſort of a Rack, like a Clothiers Rack (which they fix at every place they come to, with no more Trouble than two ſmall Poles ſet upright, and two more put a thwart, all fixed with their own Barcks,) and extend them every way by Lines, and as the Skin dries, ſo they with a dull Hatchet, or a Stick flatted, and

brought to a round edge, or a Stone fitted by nature for that purpoſe, rub them all over to force all the Water and Greaſe out of them, till they become perfectly dry: which is all they do.

And one Woman will dreſs eight or ten Skins in a day; that is, begin and end them. I intimate this becauſe the Men never do it.

Obſervationes ponderis Teſtudinis terreſtris, cum in Autumno terram ſubiret, cum ejuſdem ex Terrâ Verno tempore exeuntis pondere comparati, per plures annos repetitæ: experimento celeberrimi D. D. *Georgii Ent*, Equitis, & M. D. & à Doctiſſimo D. D. *Rob. Pitt*, M. D. & R. S. S. communicatæ.

DIE *ſeptimo Octobris, Anno* 1651. *Teſtudinem meam appendi, priuſquam latibulum adiret, ibidem per totam Hyemem hybernatura, pendebatque exactè libras* 4. *unciáſque totidem minus drachma, nempe lib.* 4. *unc.* 3. *drach.* 7.

Die octavo Octobris 1652. *Erutam è terra Teſtudinem (nam ſe pridie humaverat) appendi denuo, ponderabátque lib.* 4. *unc.* 6. *&* drach. 1.

Die 16. *Martii* 165$\frac{2}{3}$. *Teſtudo ſponte è latibulo ſuo prodiit. Pendebátque lib.* 4. *atque unc.* 4.

Die 4. *Octobris* 1653. *Teſtudo poſtquam per aliquot dies jejunaſſet, ſubtúſque terram ſeſe abſcondiſſet, inde educta atque appenſa ponderabat lib.* 4. *unc.* 5. *Oculi (quos diu clauſos habuerat) tum aperti plurimùm madeſcebant.*

Die 18. *Martii* 165$\frac{3}{4}$. *Teſtudo è latebris prodiens & in lance appenſa ponderabat lib.* 4. *unc.* 4. *& drach.* 2.

Die 6. Octob. 1654. Teſtudo ad hyberna ituriens pendebat lib. 4. unc. 9. & drach. 3..

Die Februar. ultimo 165$\frac{4}{5}$. *Teſtudo ex hyemali Cryptâ prorepens pependit lib. 4. unc. 7. drach. 6. Amiſit itaque priſtini ponderis unc. 1. drac. 5.*

Die 2. Oct. 1655. Teſtudo hyematum itura, pependit lib. 4. unc. 9. priùs autem aliquamdiu jejunaverat.

Die 25. Martii 1656. Teſtudinem è latebris hybernalibus prodeuntem appendi; erátque lib. 4. unc. 7. & dr. 2.

Die 30. Sept. 1656. Teſtudo ſubtus terram ituriens, pendebat lib. 4. & unc. 12. drac. 4.

Die 5. Martii 165$\frac{6}{7}$. *Teſtudo de ſubtus terram exiens pondo erat lib. 4. unc. 11. dr. 2. ſs.*

Unde ſatis liquet quam fixis particulis hæc Animalia, quæ ſub Terrâ ſe muniunt adverſus frigus Hybernum, conſtent, cum per tot menſes tam exigua pars corporis in ſudores aut effluvia abeat, ut an vivant necne, dum hunc in modum ſepulta jacent, merito ambigatur.

Emendationes

Emendationes & Notæ in tria loca vitioſe edita in Textu vulgato Naturalis Hiſtoriæ C. Plinii, per *E. Halley.*

DIſquiſitiones Criticas non hujus loci eſſe nonnullis forſan videbitur : attamen cum C. Plinii Hiſtoria Naturalis *à Mendis quamplurimis, quibus incuriâ ſcriptorum ubiq; fere ſcatet, repurgata, hactenus inter deſiderata ſit; cumq; Liber iſte inter Veterum Scripta Philoſophica longe nobiliſſimus habeatur, haud abs re erit, nec veritatis ſtudioſis injucundum, uni vel alteri loco ex obſcurioribus lucem afferre, ac ſi fieri poſſit genuinum Authoris ſenſum reſtituere. Etenim licet R. P.* Harduinus *in eleganti ſuâ editione* Plinii, *collatis Codicibus MSS. plurima vitiata correxerit; nonnulla tamen intacta prætermiſit, quædam etiam tentata ad mentem ſuam ſe non aſſequi poſſe ingenue fatetur. Loca vero quæ à nobis emendata ſperamus hæc ſunt.*

I. Defectus (*Solis & Lunæ*) ducentis viginti duobus menſibus redire in ſuos orbes certum eſt. Plin. Lib. 2. cap. 13. *Sic apud omnes libros impreſſos legitur, ſic apud* Harduinum, *cum tamen revera non detur talis Periodus motuum Lunarium, quocunq; ſenſu menſes hi capiantur. Nam ſi Menſes ſint Solares, quorum duodecim Annum conficiunt,* 222 *Menſes fiunt Anni octodecim cum dimidio, quibus exactis Luna non revolvitur nec ad Solem, nec ad Nodos ſuos. Deinde ſi Menſes hi ſint Lunares Synodici, ſive revolutiones Lunæ ad Solem, quorum ſinguli ſunt* 29^{d}. 12^{h}. 44′. 3″, *tum Menſes* 222 *conſtituent annos XIIX ſublatis totidem diebus, emenſôq; hoc temporis ſpatio poſt Eclipſin aliquam, Luna nunquam deficit, ſed Umbram Terræ illibatam præterit. Egregia autem motuum Lunarium Periodus abſolvitnr menſibus* 223, *nempe quâ Luna & ad Solem & ad Nodum eundem ſatis accurate revolvatur, ac parum abſit ab eodem ad Apogæum ſuum reſpectu, atq; inſuper paucis tantum gradibus ab eodem Cœli puncto diſtet. Ita ut poſt intervallum hoc, Eclipſes revera rede-*

eant in orbem, ac repetito ordine invicem ſequutæ, tam quantitate, tam cæteris circumſtantiis per omnia ſimiles ſint; nec dubium quin de hac periodo locutus fuerit Plinius, *ac legendum eſſe* Ducentis viginti tribus Menſibus.

Hac emendatione coram Societate Regiâ propoſitâ, Vir undiquaq; doctus ac nuper Societatis Præſes ac decus eximium, D. J. Hoskyns *Eques Baronettus, ſolita ſuâ ſagacitate, ſuſpicatus eſt olim ſcriptum fuiſſe numeralibus Romanis CCXXIII, ſed in Codice aliquo potiori unde forſan tranſcriberentur cæteri, vetuſtate vel caſu periiſſe ultimum I, quod quidem ita ſe habere deinde compertum eſt, cum tam in Codice MS. Chiffletiano, teſte Dalecampio, tam in MS. Regiæ Societatis è Bibliothecâ Norfolcianâ ſatis vetuſto, ſcriptum reperiatur CCXXIII.*

Periodus autem iſta egregios præſtat uſus in prædicendo Lunæ motu, tam in Eclipſibus quam alias: Quicquid enim erratum eſt in calculo aliquo loci Lunæ, etiam poſt abſolutos ducentos viginti tres Menſes Lunares, denuo errabitur. Atq; ex obſervatione aliquâ cum calculo comparatâ, tuto concludere licet Lunæ locum futurum, poſt exactum hoc intervallum, etiam ubi Numeri Aſtronomici præſtantiſſimi ultra quadrantem gradus à Cælo aberrant; id quod multoties expertus ſum cum accurato conſenſu. Sed Aſtronomicis immiſceri non ex inſtituto præſenti eſt, præſertim cum argumentum hoc peculiarem tractatum jure optimo ſibi vindicet, cuiq; etiam ſcribendo allaborare, ſi modo vacaverit, mihi in animo eſt.

Duo vero ſunt quæ hac occaſione prætermittenda non cenſeo. Primo, Sphalma illud notabile quod in Notis ſuis ad hunc Locum admiſit R. P. Harduinus *Tom. I. Pag.* 159. *his verbis.* Sunt autem Menſes 222 Lunares, anni fere Solares octodecim, cum Septem Menſibus & ſemiſſe. Totidemq;, Menſibus ad eandem Cæli partem regreditur unde digreſſa eſt (*Luna,*) cum Solem interpoſitu ſuo terris occultavit. *Etenim 222 Menſes Lunares non conficiunt XIIX Annos Solares integros, ut dictum eſt, multo mi-*

nus, cum ſeptem Menſibus & ſemiſſe adjunctis; deinde perperam dicitur Lunam regredi ad eandem Cæli partem unde digreſſa eſt, poſt completam periodum quam ſupponit; etenim ipſe exemplis quæ citat ſatis comprobavit in oppoſita Cæli parte contingere Eclipſes ſuas, nempe Octobri & Aprili, *ad ſigna Tauri & Scorpionis. Deniq;, ex iiſdem exemplis conſtat, intervallum iſtud Eclipſium ſibi reſpondentium non 7½ menſibus, ſed 6¼ tantum Annos XIIX ſuperare. Eſt autem prædicta periodus non* 222 *Menſium Lunarium ſed* 229, *eâq; completâ certis conditionibus Luminaria defectum patiuntur, ſæpius vero abſq; Eclipſi prætervehitur Luna. Unde ſubeſt mirari quo pacto vir alias literatus tam paucis verbis tot abſurda ac ſecum pugnantia ſimul conglomerare potuerit.*

Secundo loco annotare libet hanc Periodum Chaldæis olim Aſtronomiæ repertoribus Saron *dici, qua voce utitur* Diodorus Siculus *ad deſignanda veterum Regum tempora; Vox vero iſta ſcriptoribus antiquis æque ac modernis parum cognita ac varie expoſita eſt.* Suidas *vero, in loco apud Libros impreſſos vitiato, (quemq; nuper ex MS. Vaticano reſtituit Vir admodum Reverendus* Pearſonius Epiſcopus Ceſtrienſis *in doctiſſimâ ſuâ Symboli Apoſtolici Expoſitione) rectius ſaltem probabilius cæteris rem tradit his verbis,* Σάροι μέτρον καὶ ἀριθμὸς παρὰ χαλδαίοις οἱ γὰρ ρκ' σάροι ποιοῦσιν ἐνιαυτοὺς βσκβ' κατὰ τὴν χαλδαίων ψῆφον εἴπερ ὁ σάρος ποιεῖ μῆνας σεληνιακῶν σκβ', οἳ γίνονται ιή ἐνιαυτοὶ καὶ μῆνες ἕξ. *hoc eſt,* Sari menſura & numerus apud Chaldæos, etenim 120 Sari conſtituunt annos 2222 juxta Chaldæorum calculum, nempe *Saros* conſtat ex 222 menſibus Lunaribus, qui ſunt 18 Anni cum ſex menſibus. *Deſunt autem in impreſſis Codicibus verba* κατὰ τὴν χαλδαίων ψῆφον. εἴπερ ὁ σάρος ποιεῖ μῆνας σεληνιακῶν σκ'β. *Unde turbato ſenſu locus iſte inexplicatus manſit. Vide* Pearſonii *Expoſ. Symb. Apoſt. Edit.* Lond. 1683, *Fol.* 59. *Quod vero hic ſcribatur* σκ'β *pro* σκγ' *fortaſſis ex eo fluxit, quod ex Plinio, etiam Suidâ vivente corrupto, deſumi poterat iſte numerus. A Chaldaicâ vero voce* שרי *ſignificante* cæpit, inchoavit, *vox iſta* Saros *derivari videtur; quaſi ſit principium renovatæ periodi Eclipſium. Sed hæc Linguarum Orientalium peritioribus relinquo.*

II. Jecur maxime vetuſtatis patiens centenis durare annis obſidionum exempla prodidere, *Plin. lib.* 11. *cap.* 37; *ubi de viſceribus tractatur: ſic legitur in impreſſis, ſic in MS. Lugdunenſi, idq; manifeſtâ mendâ: Nullo enim modo concipi poteſt jecoris per centum annos durationem ex obſidionibus probari poſſe. Sed locus hic collatis plurium MSS. lectionibus variis, apud omnes vitiatus reperitur, teſte* Harduino *qui præter Lugdunenſem hæc citat.*

In Vaticanis N°. 1950, 1952, *Legitur* hoc ſyrio tum exempla prodidere.

In Reg. 1. *Colb* 1, 2, *& Pariſino.* hoc ſirion cum explenda prodidere.

In Reg. 2. obſidione cum explenda prodidere.

In Colb. 3. obſidione cum exempla prodidere.

His adde MS. Norfolcianum *prædictum, ubi invenitur* hoc ſirion cum exempla prodidere.

Ex quibus omnibus ſenſus non liquet, ac poſt plurima conamina irrita, etiam Harduinus *vulgatas editiones ſequitur, cum illi non conſtaret quo pacto emendari deberent.*

Ad hujus tamen obſcuri loci illuſtrationem nos operam dediſſe non pænitet, cum ſcilicet intra duorum verborum ambiguitatem rem clauſiſſe videamur. Primo autem conſiderandum venit, quæ de Jecoris duratione dicta hic ſunt, vel ad Jecur humanum vivens; vel ad Jecur aliquo modo coctum vel conditum, ac in uſum ventris per longum tempus repoſitum pertinere: neque tertium excogitari poſſe. Itaq; ſi de Jecore vivente ſermo ſit, non niſi ex valde Senibus exempla Jecorum poſt centum annos integrorum adduci poſſunt, ac ſi hoc modo ſumatur, legendum eſſe hoc ſeniorum exempla prodidere. *At ſi de Jecore cocto & exiccato dicatur, non niſi ex Jecore in Conditoriis poſt centum annos reperto probari poteſt: cumq; Conditoria ſubterranea & operta, frugibus aliiſq; rebus per longum tempus conſervandis*

dis idonea, à Varrone, Columella & Curtio, ac quod magis eſt, à Plinio ipſo lib. 18. *cap.* 30. Siri *appellentur, legi oportet* Hoc ſirorum exempla prodidere. *Utroq; modo integer & probabilis eſt ſenſus; ac juxta MSS. plurimos habetur* hoc ſiriotum *vel* ſirioncum, *quod quidem multo propius ad verba* hoc ſeniorum, *vel* hoc ſirorum *accedere videtur, quam vulgatum iſtud* obſidionum, *proculdubio ex iiſdem literis, in Codice quodam primario, vel male ſcriptis vel vetuſtate obtritis corruptum.*

Hic vero obiter notare licet hos decem MSS. ab eodem primario Codice olim tranſcriptos fuiſſe, vel mediate vel immediate, cujus in hoc loco vitium, quocunq; modo ortum, in prolem ſuam, ut ita dicam, promanavit. Unde patet quali & quam ſevero examini, ne dicam internecioni, libri omnes ſubjecti fuerint, cum nec Plinius *ipſe per orbem Romanum celeberrimus ac toties tranſcriptus, niſi unico exemplari caſu conſervato, Barbarorum vel ipſis Barbaris aſtutius literaturæ infeſtorum manus effugeret.*

III. Syriation & vomicas vulvæ curavit illa. *Plin. lib.* 20. *cap.* 14, *quo de Herbarum quarundam virtutibus agitur: hoc vero in loco de Menthæ viribus medicinalibus tractatur: ac enarrato ejus uſu ad ſiſtendam Lactis coagulationem, deinde* Hippocratis *verba refert, quod Semen genitale denſeri vel incraſſeſcere cohibeat, vel etiam diſſolvat; quo dicto, ſtatim ſequuntur hæc Verba* Syriation &c. Hippocrates *autem, quem hic ſequitur* Plinius, *quiq; in Catalago Authorum pro Libro XX reperitur, hæc habet,* Μίνθη θερμαίνει καὶ ἐρέεται, καὶ ἐμέτους ἵστησι: καὶ ἢν πολλάκις ἐσθίῃ τὶς, τὸ σπέρμα αὐτοῦ τήκει ὥστε ῥέειν, καὶ ἐντείνειν κωλύει. *de Diæta lib.* 2. *cap.* 26. Mentha Calfacit & urinam ciet & vomitus ſiſtit; ac ſi quis ſæpe comedat, ſemen genitale ejus colliquefacit ut diffluat & arrigere prohibet. *Quæcunq; vero arrigere prohibent ad compeſcendum Satyriaſin morbum proprie adhibentur, itaq; legendum videtur* Satyriaſin & vomicas Vulvæ curavit illa. *Atq; hæc noſtra ſuſpicio duplici modo confirmari videtur, primo quod*

Syriation & Satyriaſin *iiſdem fere literis ſcribantur neq; multum tranſpoſitis: deinde quod particula iſta* & *Copulativa potius videatur, ac* Syriation *morbi nomen in Accuſandi caſu innuat; quam quod pro* etiam *Intendendi Adverbium ponatur, ac* Syriation *ſit nomen Medici cujuſdam obſcuri. Voce vero* Vomica *hic peculiariter utitur Plinius, non pro Apoſtemate, ſed pro fluore quodam Uteri, id quod ex alio Plinii dicto patet.* Eſt lapis in Venis cujus Vomica liquoris æterni Argentum vivum dicitur, venenum rerum omnium. *Lib.* 33. *cap.* 6. *Ubi* Vomica *pro fluore è Lapide manante dicitur. Quod autem Mentha has etiam vires habeat audiamus* Raium *noſtrum Botanicorum præſtantiſſimum. Hiſt. Plant. pag.* 532. Mentha Menſes & album Mulierum profluvium efficaciter compeſcit. *An vero de alio quodam Mulierum affectu hæc* Plinii *verba capienda ſint ad Medicos referendum eſt.*

An account of the Meaſure of the thickneſs of Gold upon Gilt-Wire, together with a demonſtration of the exceeding minuteneſs of the Atoms or conſtituent Particles of Gold; as it was read before the R. Society, *by* E. Halley.

WHat are the Conſtituent parts of Matter, and how there comes to be ſo great a diverſity in the weight of Bodies to all appearance equally ſolid and denſe, ſuch as are Gold and Glaſs, (whoſe ſpecifick Gravities are nearly as 7 to 1) ſeems a very hard queſtion to thoſe that ſhall rightly conſider it: For from undoubted experiment, Gravity is in all Bodies proportionable to the quantity of Matter in each, and there is no ſuch thing as a propenſion of ſome more, others leſs, towards the Earths Center; ſince the Impediment of the

of the Air being removed, all Bodies deſcend, be they never ſo looſe or compact in texture, with equal velocity. It follows therefore, That there is 7 times as much matter in Gold as in a peice of Glaſs of the ſame Magnitude; and conſequently, that at leaſt ſix parts of ſeven in the bulk of Glaſs, muſt be Pore or Vacuity: This ſome favourers of the Atomical Philoſophy have endeavoured to Solve, by ſuppoſing the primary or conſtituent Atoms of Gold to be much larger than thoſe of other Bodies, and conſequently the Pores fewer; whereas in other Bodies, the great multitude of the interſperced Vacuities does diminiſh their Weights.

Being deſirous to examine this Notion of the Magnitude of Atoms of Gold, I bethought my ſelf of the Extreme Ductility of that Metal, which is ſeen in the beating of it into Leaf, and above all in the drawing fine Gilt-Wire; by means whereof, I believed I might moſt exactly obtain the true thickneſs of the Coat of Gold that appears even with the Microſcope, ſo well to repreſent Gold itſelf, that not the leaſt point of Silver appears through it. In order to this, I inform'd my ſelf among the Wire-Drawers, what Gold they us'd to their Silver, and they told me, That the very beſt double Gilt-Wire, was made out of Cylidrick Ingots 4 Inches in circumference, and 28 Inches long, which weigh 16 Pounds Troy; on theſe they beſtow 4 Ounces of Gold, that is, to every 48 Ounces of Silver one of Gold: and that two Yards of the ſuper-fine Wire weighs a Grain. Hence at firſt ſight it appear'd, that the length of 98 Yards is in weight 49 Grains, and that a ſingle Grain of Gold covers the ſaid 98 Yards, and that the 10000 th. part of a Grain is above $\frac{1}{3}$ of an Inch long; which yet may be actually divided into 10, and ſo the 100000 th. part of a Grain of Gold be viſible without a Microſcope. But being deſirous to compute the thickneſs of the Skin of Gold: by means of the ſpecifick

Gravities of the Metals, *viz.* Silver $10\frac{1}{3}$, and Gold $18\frac{2}{3}$, I found the Diameter of ſuch Wire the $\frac{1}{386}$ part of an Inch, and its Circumference the $\frac{1}{122}$ part; but the Gold in thickneſs not to exceed the $\frac{1}{134500}$ part of an Inch; whence it may be concluded, that the Cube of the hundreth part of an Inch would contain above 2433000000, (or the Cube of 1345) of ſuch Atoms. And it may likewiſe be marvelled at, that Gold being ſtretcht to ſo great a degree as is here demonſtrated, ſhould yet ſhew itſelf of ſo even and united a Texture, as not to let the white Colour of the Silver under it appear through any the leaſt Pores; which Argues that even in this exceeding thinneſs, very many of thoſe Atoms may ſtill lie one over the other: Which is a Conſideration may merit the Thoughts of this Honourable Society, as tending to examine that renowned Atomical Doctrine, which has of late of much obtained among the Learned.

Obſervationes aliquot rariores de Morboſo Liene, à Spectatiſſimo Domino D. *Nehemia Grew*, M. D. ac R. S. Socio cum eadem Societate communicatæ.

D*omini* Thomæ Sedgwick *Mercatoris* Londinenſis *Filia, decimo quarto ſuæ ætatis anno, ad Operum acupictorum Magiſtram ſe erudiendam contulit. In quibus adeò miræ fuit indolis, ut iis ſolis totos dies, eoſque ferè continuos, per biennium inſumeret. Hinc Melancholicum Temperamentum connatum in morboſum tranſiit: cui Pallor, Inappetentia, Menſium defectus, atque Tuſſis comitabantur. Et poſt tres annos, gravativus Dolor, in ſiniſtro infimoque Latere, qui ad extremum uſque diem perſtitit. Anno autem ætatis viceſimo ineunte, ex Febre obiit.*

In aperto Cadavere, Pulmones, Jecur, reliquaque Viſcera excepto ſolo Liene, ſana inveni. Hoc verò mirum in modum auctum & tumefactum; nempe craſſum ſupra duos digitos; quatuor latum; longum prope decem. Ita ut, cùm Lien Humanum, quoties ſe rectè habet, vix quinque uncias pendeat; in hac Virgine, quinque & viginti ſuperabat. Et cùm hoc Viſcus, ſicubi ægrotet, Tumoribus ſchirroſis & ſubnigris plerumque indureſcat; hîc è contra, tota ejus ſubſtantia putreſcens, quendam emittebat fætorum; molliſque adeò fuit ac digitis palpantibus diſſolubilis, ut videretur quaſi grumoſus ſanguis; atque altera pars à prehensâ alterâ, etiam ſuo pondere diſrumperetur. Nihilominus, tam exteriùs quàm intus, rubicundo floruit colore, neque ullo Apoſtemate, aut materia verè purulentâ inficiebatur.

Ex ſolitariis Inſtantiis, non eſt Sapientis δογματίζειν. *Liceat tamen ut pauliſper inquirendo philoſophemur.*

In hoc Caſu, iſta Tria ſunt conſideranda, viz. Vitæ genus, Ætas, Ætatiſque Periodus.

Primò enim à tam diuturna exercendi deſuetudine, vix potuit non evenire inæqualis Alimenti diſtributio. Quemadmodum itaque Oſſa, & ſæpe Viſcera, ex inepta Nutritione, ſupra modum augentur in Rhachitide: pariter & hîc Lien, ex eodem Nutritionis vitio, videtur ampliorem molem accepiſſe.

Præcipuè, cùm ſecundò, hâc vitæ conſuetudine uſa eſt illa Virgo, non in provectiori ætate, ſed florente adhuc adoleſcentiâ. Exercitia enim neceſſaria ſunt, etiam ad debitam nutritionem: multò magis ad Partium æquale Incrementum.

Tertiò, & in illa ipſa ætatis periodo, quâ Menſes primò effluere ſolent. Quibus inde ſuppreſſis, vel multùm imminutis, iſte ſanguis, quem deſidioſa Natura omiſit eliminare per conſuetas vias, ex parte in Lienem, quaſi quoddam diverticulum, rejiciebatur.

Corollarium. *Virginibus, nimia Exercitiorum intermiſſio, inprimis circa finem ſecundi, aut principium tertii ætatis Septenarii, peſſima.*

An Account of a Book. Oſteologia Nova, *or ſome Obſervations of the* Bones, *&c. Communicated to the Royal Society, in ſeveral Diſcourſes, Read at their Meetings, by the Learned and Accurate Author,* Clopton Havers, M. D. *and* R. S. Soc. Lond. 1691, Octavo, *for* Sam. Smith.

THE Author offering to give ſome Account of the manner, in which the Bones are firſt formed, ſuppoſes, that they, as all the other parts of the Body, are formed in the Egg before the Female is impregnated, and that the Seed of the Male does only put thoſe Particles,

which are the firſt Principles of the Spirits and Humors, into motion, by which motion they begin a Circulation, and being expanded they dilate the conteining parts, whoſe Dilatation both cauſes an Encreaſe in the Dimenſions of the Animal, and makes them more capable of the Acceſſion of new Particles to nouriſh and augment them.

Coming to deſcribe the Nature and Structure of the Parts, which are the Subject of the Diſcourſe, he begins with the *Perioſtium*, or Membrane which inveſts the Bones, which conſiſts of two ſorts of Fibres, one of which lying next to the Bone it ſelf, is derived from the *Dura Mater*, the other from the Tendons of the Muſcles. The uſe of this Membrane is to cover the Bones; To convey Spirits into them for their Senſe, and to aſſiſt in their Nutrition, to which end it has Fibres inſerted into them; To limit their Growth; To keep ſome of them conjoyn'd; To joyn the Bones and their Cartilages together; to faſten the Heads and Tendons of the Muſcles to the Bones; and laſtly, for the ſafety and ſecurity of the Bones againſt Injuries, as it ſerves to make them ſenſible, and ſo gives the Animal a quick apprehenſion of any Miſchief that threatens thoſe parts, and directs us in our application of Remedies when they are injured.

The Bones, tho they are at firſt Gelatinous, and afterwards Cartilaginous, are when they come to their true and proper nature, ſolid and hard, conſiſting of terreſtrial and ſaline Particles. Theſe Particles, being in their ſeveral Series united at their Extremities, form Strings, and theſe Strings being united make diſtinct Plates, which lying one over another make the whole Thickneſs of the Bone. In and between theſe Plates he obſerves two ſorts of Pores, ſome which run through every Plate, others which are formed between them for the Diſpenſation of the Medullary Oil to the Subſtance of the Bone. The Superficies of the Bones is unequal, being rendered ſo by ſome ſuperficial Cavities, and by paſſages which penetrate into them, the firſt of which are for enlarging their Surface, and ſtrengthening the Adheſion of their Membrane to them; the other for the ingreſs of Blood Veſſels into their Subſtance or Cavities. The Cavities of the Bones are in ſome large, in others ſmall and numerous, whoſe Partitions are formed of Plates propagated wholly from thoſe Plates, which make the ſides of the Bones in ſuch as have long Cavities; and in them which are ſpongious, from Plates which run up the whole length of the Bone in that manner. And in ſome Bones there are *Faſciculi* of Strings which run off from the Plates in the Sides, and make a ſort of *Cancelli*, or Net-work in the Cavity.

In the Bones there are Blood-Veſſels, which ſerve for their Nouriſhment, which are many; the Arteries entering at one end, and the Veins coming out in vaſt numbers, either at the contrary extremity, or in ſome intermediate parts: And there are both Veins and Arteries belonging to the Marrow.

In the Teeth he obſerves a twofold Subſtance, one of a ſtony Nature, which is the Cortical or exterior part of ſo much of the Teeth as ſtands out of the Gums; the other truly Bone, conſiſting of *Laminæ* or Plates, as the other Bones do.

In the ſecond Diſcourſe he gives an Account of the manner of Accretion, and Nutrition in general, and then particularly in the Bones. The Matter, which gives an encreaſe to the Animal, is originally from the Chyle, the Particles of which deſigned for Nouriſhment being elaborated in the Maſs of Blood, and ſo reduced nearer to the nature of a *Succus nutritius*, and diſpoſed for a Separation, are ſecerned from the ſanguineous Maſs, by Glands ſeated on the Sides of the Arteries all over the Body. And here the Author takes occaſion to ſpeak of Glandular Secretion; to explain which he obſerves, firſt that all motion in its proper tendency is direct, and that the Glandules are ſo ſeated, as to favour the motion of any Particles that ſtrike againſt them in a right Line, more than the Veins; and having Pores adapted to the Figure of the Particles which they ſeparate, the Particles do endeavour in their motion to proceed into thoſe Glandules, and being entertained by them, are ſeparated, and diſtinguiſht from the reſt of the Maſs of Blood, and ſo aſſume the form of that Liquor we find ſeparated by every Gland: And to prevent the Regurgitation of the ſeparated Matter out of the Glandules into the Maſs of Blood again, (becauſe the Ducts, which convey it to the Receptacles, do not run ſo as to favour the direct motion of the Particles,) he ſuppoſes ſome contrivance like Valves in the Pores by which the Particles enter into the Glandules.

How the Situation of the nutritous Glandules agrees with his Aſſertion, that the Glandules are ſo ſeated as to favour the motion of a Particle in a right Line, more than the Veins, is ſhown by obſerving the gradual contraction of the arterial Channel.

He then goes on with the affair of Accretion, and the account is in ſhort this, that the Nutritious Particles,being ſeparated by the Glandules plac'd in the ſides of the Arteries, are carried into thoſe ſmall nervoſe Pipes, or Interſtices of the Fibres where the Spirits move, ſo that they fall in the way of the Spirits motion. The Spirits he ſuppoſes to have a twoſold motion, one direct, the other rotatory turning upon their Axis. Whilſt the Animal is capable of Accretion, and the Particles of which the ſolid parts conſiſt are not entirely united at their extremities, but are capable of receding one from another, both laterally and at their extremities; the Spirits act upon the nutritious Particles, which are of a viſcous nature, by their rotatory motion, by which they carry them to the ſides of the Fibres and bony Strings, driving ſome againſt the ſides of their parts and forcing them out laterally; others into the Interſtices between their extremities, (thereby elongating every Series of them;) where they are apponed, and fixed, and thus the parts increaſe both in their thickneſs, and longitude. But after the Particles are united at their extremities, and no longer capable of making room to lodge the nutritious parts out of the way of the Spirits direct motion; then the Spirits come to act upon the nutritious Matter by that motion, and to drive it ſo thorough the nervous Channels that it has not the liberty of ſtopping, and adhering, and ſo the Accretion of the Animal Ceaſes.

Nutrition he makes to be no reparation of the loſs of the ſubſtance of the Solid parts ordinarily, but only a continual ſucceſſion and ſupply of Spirits, and of all thoſe fluid parts, which fill the containing parts and preſerve them diſtended.

The Rickets being a Diſtemper in which the Accretion of the Bones is concerned, he does ſuppoſe that the incurvation of the Bones is neither from a preternatural ſhortneſs of the Muſcles, nor an unequal ſupply of Spirits, and nouriſhment of the ſeveral parts of the Bones: but from a different temper in the ſeveral parts of them, that on one ſide they continue in their Affinity to the Nature of the Cartilage, whilſt on the other they approach nearer to the temper of a perfect Bone; ſo that the Particles are in one place more apt to recede and to give way for the acceſſion of new Nouriſhment: and conſequently there is a greater increaſe than in the other. From which unequal Accretion the Bone will be incurvated, and the Concave of their Arch will be on that ſide which is leaſt augmented, and the Convex on the other.

For Venereal Nodes in the Bones; he ſuppoſes that the venenoſe Matter does eat ſome little holes in the *Laminæ,* and ſo makes room for the reception of ſome of the nutritious Matter, on one ſide of the Spirits motion: and then the Spirits by their rotatory motion will determine ſome of it to thoſe little holes; ſo that if any of thoſe preternatural *Foramina* reach to the Superficies of the Bone, ſome part of the nutritious Juice will be thrown out upon the ſurface of the Bone, where indurating into a bony ſubſtance it produces gummatous inequalities.

The third Diſcourſe concerns the Marrow, which has blood Veſſels, both Veins and Arteries. The Organs by which the Medullary Oil is ſeparated, are ſmall Veſicles or Glandules, which are conglomerated into diſtinct Lobules conteined in ſeveral Membranes or Baggs, which lie conteined in one common Membrane inveſting the whole Marrow: all which both Veſicles, Baggs and Membrane are propagated from the exteriour Coat of the Arteries. The paſſage of the Medullary Oil from all parts of the Marrow to the Bone is not by Ducts, but by Pores formed in the Veſicles, by which it paſſes from one to another, till it arrives at the ſides or extreme parts of the Bone.

The Medullary Oil, which is ſupplyed to the Interſtices of the Joynts, paſſes into them by paſſages penetrating through the Bone into theſe Cavities, and formed for this end.

The uſe of the Medullary Oil is either common to all the Bones,or more proper to the Joynts. To all the Bones it is ſerviceable, and neceſſary to preſerve their temper, and keep them from being brittle. In the Articulations, Firſt, It lubricates the extremities of the Bones, and ſo makes them more apt to be moved. Secondly,It preſerves the ends of the articulated Bones from an inordinate incaleſcence. Thirdly, It prevents the Attrition of thoſe parts of the Bones, which are rubbed one againſt another. It is likewiſe beneficial to the Ligaments of the Joynts in preſerving them from dryneſs and rigidity, and lubricating thoſe parts of them, which ſlide upon the Bone. Thoſe Cartilages alſo which are joyn'd to any of the Bones it preſerves flexible.

In the fourth Diſcourſe we have an account of a particular ſort of Glands, which he calls the mucilaginous Glands ſeated in the Joynts. Theſe are of two ſorts; ſome are ſmall, and in a manner miliary Glands, being Glandules placed all upon the ſame Surface of the Membrane, which lies over the Articulations. The other ſort are conglomerate, or many Glandules collected and planted one upon another, ſo as to make a bulk, and conſiderable Glands. In ſome of the Joynts there are ſeveral of them, in ſome there is a ſingle Gland. For the Structure of theſe large Glands, they conſiſt of ſmall Veſicles, which are not gathered into ſeveral Lobules or Bags of Glandules, but are diſpoſed upon ſeveral Membranes lying one over another, of which Membranes there are ſeveral in every one of theſe Glands, which appear evidently in ſome that are Hydropical.

They have their Blood Veſſels, as other Glands, but their Veins have a particular flexure in their courſe for retarding the return of the Blood from the Glands, that the mucilaginous Liquor, which is not ſeparated with the greateſt expedition, may have time to penetrate the ſecretory Pores of the Glandules.

The large mucilaginous Glands are variouſly ſeated, ſome in a *Sinus* formed in the Joynt, others ſtand near or over againſt the Interſtice between the articulated Bones: but in general they are ſo placed as to be ſqueezed gently, and lightly preſt in the inflexion or extenſion of the Joynt, ſo as to ſeparate a quantity of Mucilage proportionate to the motion of the part, and the preſent occaſion, and yet without any injury.

We have alſo ſome deſcription of the common Membrane of the Muſcles, how it is every where ſet thick with the ſmall mucilaginous Glands; and about ſome Joynts which are often moved, and where the Tendons run backward and forward more conſiderably, it has ſome larger or conglomerate Glands.

The deſign of all theſe Glands is to ſeparate a mucilaginous kind of Liquor, that ſerves principally to lubricate the Joynts, to make them ſo ſlippery as to be moved with the greateſt facility imaginable. It ſerves likewiſe to preſerve the ends of the articulated Bones from Attrition, and an immoderate incaleſcence. But all theſe things it performs in Conjuction with the Medullary Oil. Of which two Ingredients is made a Compoſition admirably fitted for thoſe ends: For the Mucilage adds to the lubricity of the Oil, and the Oil preſerves the Mucilage from growing too thick and viſcous.

The Author obſerving the ſame ſort of Glands to lie between the Muſcles and Tendons, ſuppoſes that there is the ſame mixture of an oily and mucilaginous Subſtance, the one being that Fat which is found between the Muſcles, and is ſupplyed by the adipoſe Glands; the other being ſeparated by the mucilaginous Glandules, of which the common Membrane of the Muſcles is every where full. This mixture in the interſtices of the Muſcles lubricates them and their Tendons, and preſerves them from ſhrinking, and from growing dry and rigid.

For the Generation of this Mucilage he ſuppoſes that Nature has deſigned one large *Viſcus*, and that this is the Office of the Spleen; the Glandules of which he makes to have two ſecretory Pores, by one of which ſome Acid, and by the other ſome Auſtere Particles are ſeparated; which meeting in the ſmall Cavities of the Glandules, they are converted into a mucilaginous and gummous Subſtance, having obſerved that the Spirit of Vitriol mixt with a Decoction of Galls, will produce a Gum.

In the next place follows an account of ſome Experiments made with the Mucilage, the moſt of which come to this, that all Acids do coagulate it, as all Auſteres, and Auſtere Acids: but with this difference that the *Coagulum* or Curd made with Acids only is tenderer than that which is produced by an Auſtere only, or an Auſtere Acid.

Theſe Experiments being made and deſcribed in order to explain the Nature and Cauſes of a Rheumatiſm, and the Gout, theſe Diſtempers are next treated of.

The Matter or Humour producing a Rheumatiſm is made to have a different Nature in ſeveral Patients; in ſome it is Acid, in ſome Saline, and in others Acrious. This Matter whilſt it lies in the Maſs of Blood, temperd with the other parts, ſcarce gives any ſenſible effect: but the mucilaginous Glands between the Muſcles, (as we ſee other Glands of the Body often do,) ſerving ſometimes for the Depuration of the Sanguineous Maſs, by ſeparating from it incongruous and morbifick Particles, this Matter ſo ſeparated comes to be more ſtrong and ſincere, ſo as to have a ſenſible effect upon the Fibres, pricking and irritating of them, and if the Matter be an Acid or Auſtere, it affects the Mucilage it ſelf, ſo as to coagulate it in the Interſtices of the Muſcles, which produces that Rheumatiſm, which is fixt, and where the Blood is very ſizy.

As there is a difference in the Matter, which produces the Diſtemper, ſo it is to be treated with different means. Where the Matter is thin and acrious; with temperate and cooling Medicines, together with ſuch gentle Diaphoreticks, as have themſelves no Acrimony. Where the Humour is ſalt; with diluting and aqueous things together with ſome Diureticks. And when the Mucilage is coagulated with an Acid above other things, the moſt proper Medicines ſeem to be ſuch as diſſolve a *Coagulum,* ſuch are *Oleum Tartari per deliquium,* Spirit of Salt Armoniack, and Spirit of Harts-Horn.

In the Gout the humour likewiſe is of a different Nature; ſometimes Acid, or Saline, and ſometimes Acrious. This Matter is ſeparated in the manner of a *Criſis* by the mucilaginous Glands of the Joynts, where it always affects the ſenſible parts about them; and if it be Acid makes a Coagulation, or inſpiſſates the Mucilage, and then the Gout ſticks ſome conſiderable time. The generation of the *Tophaceous* Matter in the nodoſe Gout is accounted for, from the Experiments made with Acid-Auſtere Liquors mixed with the Mucilage; ſo that where the Gout is nodoſe, the Mucilage is firſt coagulated by ſome Acid-Auſtere Matter, and the *Coagulum* made by ſuch a Matter is not ſo eaſily diſſolved, as when it is made by an Acid only. This *Coagulum* therefore being impriſoned, and the more groſs and earthy parts being uncapable of an evaporation or being otherwiſe ſpent, are concentrated and indurated by the evaporation or flowing off of the moiſt Particles, and ſo produce a hard, and chalkey Subſtance.

The laſt Diſcourſe is of the Cartilages, which approach near to the Nature of Bones, but differ from them in their Formation, and in their flexibility: This flexibility is from the Figure and order of their parts, which are ſuch that the Particles (as they muſt ſlide one way or other in the inflexion of a Body) may move without interrupting the continuity of the whole, even when they recede from one another, unleſs they are forced too far. That recoyling, which is found in theſe and other flexible Bodies that have a rigidity, ariſes from a preſſure made by the ſpring of the Air, either implanted and ſhut up in the interſtices of the Particles, as when the Particles are driven nearer to one another, and thoſe Interſtices are contracted: or by the Elaſtick power of the external Air, when the Particles of the Body recede from one another, and drive up the ſpring of that Air.

The Cartilages have a Membrane every way like to the *Perioſtium*, and is a continuation of it, where they are joyned to any Bones. Blood Veſſels they likewiſe have in great numbers.

The uſe of the Cartilages in general is to give a ſtrength to ſome parts, which did ſtand in need of ſuch Bodies as both were flexible and had a rigidity. Thoſe of the Ribs are deſigned to make them capable of an Elongation, that ſo they may protrude the *Sternum* one way, and drive back the *Vertebres* of the Breaſt the other, whereby there is an addition made to the capacity of the Breaſt. Theſe Griſtles ſerve likewiſe in the contraction of the Breaſt. For having their natural Figure altered in the elevation of the Ribs, and the ampliation of the Cavity of the *Thorax*, they do naturally endeavour to regain their firſt Figure, and to return into their proper poſture, by which endeavour they help ſomething towards the depreſſion of the Ribs, and the contracting the Cavity of the Breaſt.

FINIS.

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The CONTENTS.

1. AN *Account of the ſeveral Species of* Infinite Quantity, *and of the Proportions they bear one to the other, as it was read before the* Royal Society, *by* E. Halley. 2. *A Diſcourſe concerning the Muſical Notes of the* Trumpet *and* Trumpet-Marine, *and of the Defects of the ſame, by the Honourable* Francis Roberts *Eſq*; R. S. S. 3. *An Account of the Cauſe of the Change of the Variation of the* Magnetical Needle, *with an Hypotheſis of the Structure of the Internal parts of the Earth: as it was propoſed to the* Royal Society, *in one of their late Meetings, by* E. Halley.

An Account of the ſeveral Species of Infinite Quantity, *and of the Proportions they bear one to the other, as it was read before the* Royal Society, *by* E. Halley.

THAT all Magnitudes infinitely great, or ſuch as exceed any aſſignable Quantity, are equal among themſelves, though it be vulgarly received for a Maxim, is not yet ſo common as it is erroneous; and the reaſon of the Miſtake ſeems to be, That the Mind of Man, coming to contemplate the Extenſions of what exceeds the bounds of its Capacity, and of which the very Idea does include a negation of Limits; it comes to paſs that we acquieſce generally, andit ſuffices to ſay ſuch a Quantity is infinite.

But if we come more nearly to examine this Notion, we ſhall find, that there are really beſides infinite *Length* and infinite *Area*, no leſs than Three ſeveral ſorts of infinite Solidity: all of which are *Quantitates ſui generis,* having no more relation or proportion the one to the other, than a Line to a Plane, or a Plane to a Solid, or a Finite to an Infinite: but that among themſelves each of thoſe Species of Infinites are in given Proportions, is what I now intend to make plain, if poſſible.

But firſt, infinite *Length* or a Line infinitely long is to be conſidered either as beginning at a point, and ſo infinitely extended one way, or elſe both ways from the ſame Point; in which caſe the one, which is a beginning Infinity, is the one half of the whole, which is the ſumm of the beginning and ceaſing Infinity, or as I may ſay of Infinity *a parte ante* and *a parte poſt*, which is analogous to Eternity in time or Duration, in which there is always as much to follow as is paſt from any point or moment of Time: Nor doth the Addition or Subduction of finite Length or Space of time alter the caſe either in Infinity or Eternity, ſince both the one or the other cannot be any part of the whole.

As to Infinite *Surface* or *Area*, any right Line, infinitely extended both ways on an infinite Plane, does divide that infinite Plane into equal parts, the one to the right and the other to the left of the ſaid Line; but if from any point in ſuch a Plane two right Lines be infinitely extended ſo as to make an Angle, the infinite Area, intercepted between thoſe infinite right Lines, is to the whole infinite Plane, as the Arch of a Circle, on the point of concourſe of thoſe Lines as a Centre, intercepted between the ſaid Lines is to the Circumference of the Circle; or as the Degrees of the Angle to the 360 Degrees of a Circle. For example, two right Lines meeting at a right Angle do include, on an infinite Plane, a quarter part of the whole infinite Area of ſuch a Plane.

But if ſo be two parallel infinite Lines be ſuppoſed drawn on ſuch an infinite Plain, the Area intercepted between them will be likewiſe infinite; but at the ſame time will be infinitely leſs than that Space which is intercepted between two infinite Lines that are inclined, tho with never ſo ſmall an Angle, for that in the one caſe the given finite Diſtance of the parallel Lines diminiſhes the Infinity in one degree of Dimenſion; whereas in a Sector, there is Infinity in both Dimenſions: and conſequently the Quantities are the one infinitely greater than the other, and there is no Proportion between them.

From the ſame Conſideration ariſe the Three ſeveral Species of infinite Space or Solidity, as has been ſaid, for a Parallelepipide or a Cylinder infinitely long is greater than any finite Magnitude how great ſoever, and all ſuch Solids ſuppoſed to be formed on given Baſes, are as thoſe Baſes, in proportion to one another. But if two of theſe Three Dimenſions are wanting, as in the ſpace intercepted between two parallel Planes infinitely extended and at a finite diſtance; or with infinite Length and Breadth with a finite Thickneſs: all ſuch Solids ſhall be as the given finite Diſtances one to another; but theſe Quantities, tho infinitely greater than the other, are yet infinitely leſs than any of thoſe wherein all the three Dimenſions are infinite. Such are the Spaces intercepted between two inclined Planes infinitely extended; the Space intercepted by the Surface of a Cone or the ſides of a Pyramid likewiſe infinitely continued, *&c.* of all which notwithſtanding, the Proportions one to another, and to the τὸ πᾶν or vaſt Abyſs of infinite ſpace (wherein is the *Locus* of all things that are or can be; or to the ſolid of infinite Length, Breadth and Thickneſs taken all manner of ways) are eaſily aſſignable. For the ſpace between two Planes is to the whole, as the Angle of thoſe Planes to the 360 Degrees of the Circle. As for Cones and Pyramids they are as the ſpherical Surface, intercepted by them, is to the Surface of the Sphere, and therefore Cones are as the Verſed ſines of half their Angles, to the Diameter of the Circle: Theſe three ſorts of infinite Quantity are analogous to a Line, Surface and Solid, and after the ſame manner cannot be compared, or have no proportion the one to the other.

Beſides theſe, there are ſeveral other Species of infinite Quantity, ariſing from the contemplation of Curves and their Aſymptotes, which by reaſon of the difficulty of the Subject cannot be made ſo plain to moſt Readers; but what has been already ſaid may be ſufficient to evince what we undertook to explain.

A Diſcourſe concerning the Muſical Notes of the Trumpet, and Trumpet-Marine, and of the defects of the ſame, by the Honourable Francis Roberts, *Eſq;* ℞. *S. S.*

THE Trumpet ſo famous in all Ages for its uſe in War, the lowdneſs and nobleneſs of its ſound peculiarly ſuiting it to that purpoſe, is nevertheleſs to be reckon'd among the imperfect Muſical Inſtruments. For though it has a large compaſs, the greater part of the intermediate Notes are wanting, and ſome of them imperfect. The extent of this Inſtrument cannot be ſtrictly determined, it reaches as high as the ſtrength of the breath can force it, but by conſidering its Notes within the ordinary compaſs of the Scale of Muſick (from double *C fa-ut* to *C ſol-fa* in *alt*) the nature of the higher Notes will plainy appear. Theſe are all ſet down in the Table (Fig. 1.) only take notice that the Prickt Notes are imperfect, not being exactly in Tune, but a little flatter or ſharper than the places where they ſtand, according as *f* or *s* is ſet over them.

Here we may make two inquiries.

1. Whence it comes to paſs that the Trumpet will perform no other Notes (in that compaſs) but only thoſe in the Table, which are uſually called by Muſicians Trumpet Notes.

2. What is the reaſon that the 7th. 11th. 13th. and and 14th. Notes are out of Tune, and the others exactly in Tune.

In this matter we may receive ſome light from the Trumpet-Marine, an Inſtrument though as unlike as poſſible to the Trumpet in its frame (one being a Wind-Inſtrument, the other a Monochord) yet has a wonderful agreement with it in its effect.

The ſound is ſo like as not to be eaſily diſtinguiſhed by the niceſt Ear, and as it performs the very ſame Notes, ſo it has the ſame defects as a Trumpet, for if the String be ſtop'd in any part, but ſuch as produces a Trumpet Note, it yields a harſh and uncouth (not a Muſical) ſound.

Let us therefore proceed to our firſt inquiry, and examine what is the reaſon that the Trumpet-Marine will perform no other but the Trumpet Notes.

It is a known Experiment of two Uniſon Strings, that ſtriking one of them moves the other, which probably proceeds from hence, that the impulſes of the Air which are made by one String, do more eaſily ſet another in motion which lies in a diſpoſition to have its vibration *Synchronous* to them, than a third whoſe motion would be croſs.

We may improve this a little farther, by obſerving that a String will move not only at the ſtriking of a Uniſon, but an 8th. or 12th, though after a different manner.

If a uniſon is ſtruck, it makes one intire vibration in the whole String, as in Fig. *A*, and the motion is moſt ſenſible in the middle at *m*, for there the vibrations take the greateſt ſcope.

If an 8th. is ſtruck, it makes two vibrations, as in Fig. *B*, and then the point *m* is in a manner quieſcent, and the moſt ſenſible motion at *n*, *n*.

If a 12th. be ſtruck, then it makes three vibrations, as in Fig. *C*, and the greateſt motion at *q*, *m*, *q*, and hardly to be perceived at *p*, *p*. All which may be plainly experimented by putting a little piece of paper upon the ſeveral parts of the String to make the motion more conſpicuous.

So that in ſhort this Experiment holds when any Note is ſtruck which is a uniſon to ſome *aliquot part* of the String, as in the former Examples, an 8th. is uniſon to half the String, and a 12th. to a third part of it.

In this caſe (the vibrations of the equal parts of a String being *Synchronous*) there is no contrariety in their motion to hinder each other, whereas it is otherwiſe if a Note is uniſon to *ſ*, in the Fig. *D*, that does not divide the String into equal parts, for then the vibrations of the remainder *r* not ſuting with thoſe of the other parts, immediately make a confuſion in the whole.

Now in the Trumpet-Marine you do not ſtop cloſe as in other Inſtruments, but touch the String gently with your Thumb, whereby there is a mutual concurrence of the upper and lower part of the String to produce the ſound. This is ſufficiently evident from that, if any thing touches the String below the ſtop, the ſound will be as effectually ſpoyled as if it were laid upon that part which is immediatly ſtruck with the Bow.

From hence therefore we may collect, that the Trumpet-Marine will yield no Muſical ſound but when the ſtop makes the upper part of the String an *aliquot* of the remainder, and conſequently of the whole: otherwiſe as we juſt now remark'd of Fig. *D*, the vibrations of the parts will croſs one another, and make a ſound ſutable to their motion, altogether confus'd.

Now that theſe *aliquot parts* are the very ſtops which produce the Trumpet Notes ſhall be plainly ſhown in treating of the ſecond enquiry, *viz.* What is the reaſon that the 7th. 11th. 13th. and 14th. Notes are out of Tune, and the reſt exactly in Tune.

All Writers of the Mathematical part of Muſick agree

That by ſhortning a String	the ſound is rais'd
half	an eighth
a third part	a fifth
a fourth	a fourth
a fifth	a ſharp third
a ſixth	a flat third.

From this Foundation all the other Notes are derived. The flat and ſharp ſixth are to be the flat and ſharp third to the fourth; and the ſeventh the like to the fifth: the ſecond to be a fifth to the fourth below, *&c.* By this Rule let us examine what Notes a Monochord fretted in its aliquot parts will produce.

Suppoſe the Monochord *F* to conſiſt of 720 parts, and its Tone double *C fa-ut* the firſt Note in the Table; then half of it will be 360, and a third part 240, *&c.*

Now I ſay, fretting, (or ſtopping with the Thumb) at 360 muſt produce *C fa ut*, becauſe 360 being half 720, the ſound will riſe an eighth from double *C fa-ut*.

Again 360 being *C fa-ut*, 240 muſt make *G ſol-re-ut* the third Note in the Table, becauſe 240 being juſt a third part leſs than 360, the ſound will riſe a fifth from that Note. After the ſame manner proceeding ſtep by ſtep it will be evident that,

180	which is leſs than	240	by juſt	a 4th.	produces	*C ſol fa-ut*	the 4th.	Note in the Table.
144		180		a 5th.		E *lami*	5th.	
120		144		a 6th.		G *ſol-re ut*	6th.	
90		180		half		C *ſol-fa*	8th.	
80		120		a 3d.		*D la-ſol*	9th.	
72		90		a 5th.		E *lami*	10th.	
60		90		a 3d.		G *ſol re-ut*	12th.	
48		60		a 5th.		*B fabimi*	15th.	
45		90		half		*C ſol-fa*	16th.	

By the ſame Reaſon,

100	which is leſs than	120	by juſt	a 6th.	produces	*B fabimi* flat,
$67\frac{1}{2}$		90		a 4th.		*F fa-ut*,
54		$67\frac{1}{2}$		a 5th.		*A lamire*,
50		100		half		*B fabimi* flat.

And Conſequently,

$102\frac{6}{7}$	the 7th.	Note in the Table is a little	flatter	then	*B fabimi* flat,
$65\frac{5}{11}$	11th.		ſharper		*F fa-ut*,
$55\frac{5}{13}$	13th.		flatter		*A lamire*,
$51\frac{3}{7}$	14th.		flatter		*B fabimi* flat.

Which anſwers the ſecond Inquiry.

Now to apply this (in a few words) to the Trumpet, where the Notes are produced only by the different force of the breath; it is reaſonable to imagine that the ſtrongeſt blaſt raiſes the ſound by breaking the Air within the Tube into the ſhorteſt vibrations, but that no Muſical ſound will ariſe unleſs they are ſuted to ſome aliquot part, and ſo by reduplication exactly meaſure out the whole length of the Inſtrument, as in Fig. *C*, for otherwiſe a remainder will cauſe the ſame inconvenience in this caſe, as in Fig. *D*. To which if we add that a Pipe, being ſhortned according to the Proportions we even now diſcours'd of in a String, raiſes the ſound in the ſame degrees, it renders the caſe of the Trumpet juſt the ſame with the Monochord.

For a Corollary to this Diſcourſe, we may obſerve that the diſtances of the Trumpet Notes aſcending, continually decreaſed in proportion of $\frac{1}{1}$ $\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{5}$. in *infinitum*, For,

$$\text{The}\left\{\begin{array}{l}\text{ſecond}\\ \text{third}\\ \text{fourth}\end{array}\right.\left\{\begin{array}{l}\text{Note in the}\\ \text{Table, differs}\\ \text{from the}\end{array}\right.\left\{\begin{array}{l}\text{firſt}\\ \text{ſecond}\\ \text{third}\end{array}\right\}\text{by}\left\{\begin{array}{c}\frac{1}{2}\\ \frac{1}{3}\\ \frac{1}{4}\end{array}\right\}\text{of the String, \&c.}$$

An Account of the cauſe of the Change of the Variation of the Magnetical Needle. with an Hypotheſis of the Structure of the Internal parts of the Earth: as it was propoſed to the Royal Society *in one of their late Meetings.* *By* Edm. Halley.

SOme years ſince I publiſhed in theſe Tranſactions, (Numb. 148.) a Theory of the Variation of the Magnetical Compaſs, wherein having collected as many Obſervations as at that time I could procure, and having carefully compared them together, I came at length to this general concluſion, *That the Globe of the Earth might be ſuppoſed to be one great Magnet, having four Magnetical Poles or Points of Attraction, near each Pole of the Equator two: and that in thoſe parts of the World which lie near adjacent to any one thoſe Magnetical Poles, the Needle is chiefly governed thereby; the neareſt Pole being alwaies predominant over the more remote.* And I there have endeavoured to ſtate and limit the preſent poſition of thoſe Poles in the Surface of our Globe, which the Reader pleaſing to conſult will ſave us the pains of repeating. But after all, though that Diſcourſe was favourably received both at home and abroad, as ſeeming to render a tollerable account of the obſerved Variations, yet I found two difficulties not eaſie to ſurmount, the one was that no Magnet I had ever ſeen or heard of, had more than two oppoſite Poles; whereas the Earth had viſibly four, and perhaps more. And ſecondly, it was plain that theſe Poles were not, at leaſt all of them, fixt in the Earth, but ſhifted from place to place, as appeared by the great changes in the Needles direction within this laſt Century of years, not only at *London*, (where this great Diſcovery was firſt made,) but almoſt all over the Globe of Earth; whereas it is not known or obſerved that the Poles of a Load-Stone ever ſhifted their place in the Stone, nor (conſidering the compact hardneſs of that ſubſtance,) can it eaſily be ſuppoſed: Though the Matter of Fact be too notorious and univerſal, not to be accounted for.

Theſe difficulties had wholly made me deſpond, and I had long ſince given over an inquiry I had ſo little hopes of; when in accidental diſcourſe, and leaſt expecting it, I ſtumbled on the following Hypotheſis; in delivering whereof, if I ſhall ſeem to advance any thing that looks like Extravagant or Romantick, the Reader is deſired to ſuſpend his cenſure, till he have conſidered the force and number of the many Arguments which concurr to make good ſo new and ſo bold a Suppoſition.

Though it be ſufficiently known and allowed that the Needles Variation changes, it will be neceſſary however to give a few inſtances, whereby it may appear that this change is gradual and univerſal, and the effect of a great and permanent motion. For which take the following Examples.

At *London* in the year 1580. the Variation was obſerved by Mr. *Burrows* to be 11°. 15' Eaſt. In *Anno* 1622. the ſame was found by Mr. *Gunter* to be but 6°. 0' Eaſt. In the year 1634. Mr. *Gellibrand* found it 4°. 5' Eaſt. In 1657. Mr. *Bond* obſerved that there was no Variation at *London*. *Anno* 1672. my ſelf obſerved it 2°. 30' to the Weſt; and this preſent year 1692. I again found it 6°. 00' Weſt. So that in 112 years the direction of the Needle has changed no leſs than 17 degrees.

At *Paris*. *Orontius Finæus* about the year 1550. did accout it about 8 or 9 degrees Eaſt Variation. *Anno* 1640. it was found 3 degrees Eaſt. *Anno* 1666, there was no Variation there, and *Anno* 1681. I found it to be 2°. 30' to the Weſt.

At *Cap d' Agulhas*, the moſt ſoutherly Promontory of *Africa*, about the year 1600. the Needle pointed due North and South without Variation, whence the *Portugueze* gave it its name. *Anno* 1622. there was 2 degrees Weſt Variation. *Anno* 1675. it was 8°. 00 Weſt; and this year 1691. it was curiouſly obſerved not leſs than 11 degrees Weſt.

At St. *Helena*, about the year 1600. the Needle declined 8 degrees to the Eaſt. *Anno* 1623. it was but 6°. 00' Eaſt. *Anno* 1677. when I was there, I obſerved it accurately on ſhore to be 0 *d.* 40' Eaſt; and now this year it was found about 1 *d.* to the the Weſtward of the North.

At *Cape Comorine* in *India*, in the Year 1620. there was 14° 20′ Weſt Variation; in the Year 1680. there was 8° 48′, but now lately in the Year 1688. it was no more than 7° 30′, ſo that here the Needle has returned to the Eaſt about ſeven degrees in ſeventy Years.

In all the other Examples the Needle has gradually moved towards the Weſt, and the places are too far aſunder to be influenced by the removal of any Magnetical matter, which may by accident be tranſplaced within the Bowels or on the Surface of the Earth. If more Examples are deſired, the Reader may be furniſhed with them in the *Portugueze Routier* of *Aleixo de Motta* (written about the year 1600,) and in the Voyage of *Beaulieu*, both publiſhed in Mr. *Thevenot*'s firſt Collection of curious Voyages, printed at *Paris*, *anno* 1663. which he is to compare with the Journals of of our late *Eaſt India* Voyagers, and I am aſſured that it will be thereby evident, that the Direction of the Needle is in no place fixt and conſtant, tho in ſome it change faſter than in others. And where for a long time it has continued as it were unaltered, it is there to be underſtood that the Needle has its greateſt deflection, and is become Stationary in order to return, like the Sun in the Tropick. This at preſent is in the *Indian* Sea, about the Iſland *Mauritius*, where is the higheſt Weſt Variation, and in a Tract tending from thence into the N. N. W. towards the *Red Sea* and *Egypt*. And in all Places to the Weſtward of this Tract, all over *Africa* and the Seas adjoining, the Weſt Variation will be found to have encreaſed; and to the Eaſtwards thereof, as in the example of *Cape Comorine*, to have decreaſed, *viz*, all over the *Eaſt Indies* and the Iſlands near it.

After the like manner in that Space of Eaſt Variation which, beginning near St. *Helena*, is found all over the

South *America*, and which at preſent is higheſt about the Mouth of *Rio de la Plata*, it has been obſerved that in the Eaſtern parts thereof, the Variation of the Needle gradually decreaſes; but whether on the contrary it increaſes in thoſe places which lie more Weſterly than that tract wherein the higheſt Eaſt Variation is found; or how it may be in the vaſt *Pacifick* Sea, we have not experience enough to aſcertain, only we may by Analogy infer, that both the Eaſt and Weſt Variations therein do gradually increaſe and decreaſe after the ſame Rule.

Theſe *Phænomena* being well underſtood and duly conſidered do ſufficiently evince, That the whole magnetical Syſtem is by one or perhaps more Motions tranſlated, whether Eaſtwards or Weſtwards I ſhall anon diſcuſs; that this moving thing is very great, as extending its effects from Pole to Pole; and that the Motion thereof is not *per ſaltum*, but a gradual and regular Motion.

Now conſidering the ſtructure of our *Terraqueous* Globe, it cannot be well ſuppoſed that a very great part thereof can move within it, without notably changing its Centre of Gravity and the Equilibre of its parts, which would produce very wonderful Effects in changing the Axis of Diurnal Rotation, and occaſion ſtrange alteration in the Sea's Surface, by Inundations and Receſſes thereof, ſuch as Hiſtory never yet mentioned. Beſides, the ſolid parts of the Earth are not to be granted permeable by any other than fluid Subſtances, of which we know none that are any ways Magnetical. So that the only way to render this Motion intelligible and poſſible, is, to ſuppoſe it to turn about the Centre of the Globe, having its Centre of Gravity fixt and immoveable in the ſame common Centre of the Earth: And there is yet required that this moving internal Subſtance be looſe and detached from the external parts of the Earth, whereon we live; for otherwiſe were it affix'd thereto, the whole muſt neceſſarily move together.

So then the External Parts of the Globe may well be reckoned as the Shell, and the Internal as a *Nucleus* or inner Globe included within ours, with a fluid medium between. Which having the ſame common Centre and Axis of diurnal Rotation, may turn about with our Earth each 24 hours; only this outer Sphere having its turbinating Motion ſome ſmall matter either ſwifter or ſlower than the internal Ball. And a very minute difference in length of time, by many repetitions becoming ſenſible; the Internal parts will by degrees recede from the External, and not keeping pace with one another will appear gradually to move either Eaſtwards or Weſtwards by the difference of their Motions.

Now ſuppoſing ſuch an Internal Sphere having ſuch a Motion, we ſhall ſolve the two great difficulties we encountred in my former Hypotheſis. For if this exterior Shell of Earth be a Magnet having its Poles at a diſtance from the Poles of Diurnal Rotation; and if the Internal *Nucleus* be likewiſe a Magnet, having its Poles in two other places diſtant alſo from the Axis; and theſe latter by a gradual and ſlow Motion change their place in reſpect of the External; we may then give a reaſonable account of the four Magnetical Poles I preſume to have demonſtrated in *No.* 148. of theſe Tranſactions; as likewiſe of the changes of the Needles Variations, which till now hath been unattempted.

The Period of this Motion being wonderful great, and there being hardly an hundred Years ſince theſe Variations have been duly obſerved, it will be very hard to bring this Hypotheſis to a Calculus, eſpecially ſince, tho the Variations do increaſe and decreaſe regularly in the ſame place, yet in differing places, at no great diſtance, there are found ſuch caſual Changes thereof as can no ways be accounted for by a regular Hypotheſis; as depending upon the unequal and irregular diſtribution of the Magnetical matter within the ſubſtance of the External ſhell or coat of the Earth, which deflect the Needle from the poſition it would acquire from the effect of the general Magnetiſm of the whole. Of this the Variations at *London* and *Paris* give a notable inſtance, for the Needle has been conſtantly about 1° ½ more Eaſterly at *Paris* than at *London*; tho it be certain that according to the general effect the difference ought to be the contrary way. Notwithſtanding which the Variations in both places do change alike.

Hence, and from ſome other of like nature, I conclude, That the two Poles of the external Globe are fixt in the Earth, and that if the Needle were wholly governed by them, the Variations thereof would be always the ſame, with ſome little Irregularities upon the account I but juſt now mentioned: But the internal Sphere having ſuch a gradual tranſlation of its Poles, does influence the Needle and direct it variouſly according to the reſult of the attractive or directive power of each Pole; and conſequently there muſt be a period of the Revolution of this internal Ball, after which the Variations will return again as before. But if it ſhall in future ages be obſerved otherwiſe, we muſt then conclude that there are more of theſe Internal Spheres, and more Magnetical Poles than Four, which at preſent we have not a ſufficient number of Obſervations to determine, and particularly in that vaſt *Mar del Zur*, which occupies ſo great a part of the whole Surface of the Earth.

If then two of the Poles be fixt and two moveable, it remains to aſcertain which they are that keep their place: and tho I could wiſh we had the experience of another Century of years to found our Concluſions upon, yet I think we may ſafely determine, *That our*

European North Pole (which in *No.* 148. I ſuppoſed near the Meridian of the Lands End of *England*, and about ſeven degrees therefrom) is that that is moveable of the two Northern Poles, and that that has chiefly influenced the Variations in theſe parts of the World: For in *Hudſon's* Bay, which is under the Direction of the *American* Pole, the change is not obſerved to be near ſo faſt as in theſe parts of *Europe*, tho that Pole be much farther removed from the Axis.

As to the *South Poles*, I take the *Aſian* Pole, which I place about the Meridian of the Iſland *Celebes* to be the fixt, and conſequently the *American* Pole to move; from the like obſervation of the ſlow decreaſe of the Variation on the Coaſt of *Java*, and near the Meridian of the *Aſian* Pole; tho I muſt confeſs to have no account of the effects of the other beyond *Magellan's* Streights:

If this be allowed me, 'tis plain that the fixt Poles are the Poles of this External Shell or *Cortex* of the *Earth*, and the other two the Poles of a Magnetical *Nucleus* included and moveable within the other. It likewiſe follows, that this Motion is Weſtwards, and by conſequence that the aforeſaid *Nucleus* has not preciſely attained the ſame degree of Velocity with the exteriour parts in their Diurnal Revolution: but ſo very nearly equals it that in 365 Revolves the difference is ſcarce ſenſible. This I conceive to ariſe from the Impulſe whereby this diurnal Motion was impreſt on the Earth, being given to the external parts, and from thence in time communicated to the internal; but not ſo as perfectly to equal the Velocity of the firſt Motion impreſſed on, and ſtill conſerved by the ſuperficial parts of the Globe.

As to the Quantity of this Motion it is almoſt impoſſible to define it, both from the Nature of this kind of Obſervation, which cannot be very accurately performed, as alſo from the ſmall time theſe Variations have been obſerved, and their change diſcovered. It appears by all Circumſtances, that its period is of many Centuries of Years, and as far as may be collected from the Change of the Place, where there was no Variation by reaſon of the Equilibre of the two Southern Magnetical Poles, *viz.* from *Cape d' Agulhas* to the Meridian of St. *Helena* (which is about 23^{gr} in about 90 years) and of the place where the Weſterly Variation is in its *ἀκμὴ* or greateſt Deflection, being about half ſo much, *viz,* from the Iſle of *Diego Roiz* to the South Weſt parts of *Madagaſcar.* We may with ſome Reaſon conjecture, that the *American* Pole has moved Weſtwards 46 degrees in that time, and that the whole Period thereof is performed in 700 Years, or thereabouts; ſo that the nice Determination of this and of ſeveral other particulars in the Magnetick Syſtem is reſerved for remote Poſterity; all that we can hope to do is to leave behind us Obſervations that may be confided in, and to propoſe Hypotheſes which after Ages may examine, amend or refute. Only here I muſt take leave to recommend to all Maſters of Ships and all others, Lovers of natural Truths, that they uſe their utmoſt Diligence to make, or procure to be made, Obſervations of theſe Variations in all parts of the World, as well in the North as South Latitude (after the laudable cuſtom of our *Eaſt-India* Commanders) and that they pleaſe to communicate them to the *Royal Society*, in order to leave as compleat a Hiſtory as may be to thoſe that are hereafter to compare all together, and to compleat and perfect this abſtruſe Theory.

And by the way it will not be amiſs to amend a received Error in the Practice of obſerving the Variation, which is, to take it by the Amplitude of the Riſing and Setting Sun, when his Centre appears in the viſible Horizon; whereas he ought to be obſerved when his under

Limb is ſtill above the Horizon about $\frac{2}{3}$ of his Diameter, or 20 Minutes, upon the ſcore of the Refraction, and the height of the Eye of the Obſerver above the Surface of the Sea: Or elſe they are to work the Amplitudes as they do the Azimuth, reckoning the Sun's diſtance from the Zenith 90° 36′: This, tho it be of little conſequence near the Equinoctial, will make a great error in high Latitudes, where the Sun riſes and ſets obliquely.

But to return to our Hypotheſis, In order to explain the change of the Variations, we have adventured to make the Earth hollow and to place another Globe within it: and I doubt not but this will find Oppoſers enough. I know 'twill be objected, That there is no Inſtance in Nature of the like thing; That if there was ſuch a middle Globe it would not keep its place in the Centre, but be apt to deviate there-from, and might poſſibly chock againſt the concave Shell, to the ruine or at leaſt endammaging thereof; That the Water of the Sea would perpetually leak through, unleſs we ſuppoſe the Cavity full of Water; That were it poſſible yet it does not appear of what uſe ſuch an inward Sphere can be of, being ſhut up in eternal Darkneſs, and therefore unfit for the Production of Animals or Plants; with many more Objections, according to the Fate of all ſuch new Propoſitions.

To theſe, and all others that I can foreſee, I briefly anſwer. That the Ring environing the Globe of *Saturn* is a notable Inſtance of this kind, as having the ſame common Centre, and moving along with the Planet, without ſenſibly approaching him on one ſide more than the other. And if this Ring were turned on one of its Diameters, it would then deſcribe ſuch a concave Sphere as I ſuppoſe our External one to be. And ſince the Ring in any poſition given, would in the ſame manner keep the Centre of *Saturn* in its own, it follows that ſuch a concave Sphere may move with another included in it, having the ſame common Centre. Nor can it well be ſuppoſed otherwiſe, conſidering the Nature of Gravity, for ſhould theſe Globes be adjuſted once to the ſame common Centre, the Gravity of the parts of the Concave would preſs equally towards the Centre of the inner Ball, which Equality muſt neceſſarily continue till ſome external force diſturb it, which is not eaſie to imagine in our caſe. This perhaps I might more intelligibly expreſs, by ſaying that the inner Globe being poſited in the Centre of the exterior, muſt neceſſarily aſcend which way ſoever it move; that is, it muſt overcome the force of Gravity preſſing towards the common Centre, by an impulſe it muſt receive from ſome outward Agent; but all outward efforts being ſufficiently fenced againſt by the Shell that ſurrounds it, it follows, that this *Nucleus* being once fixt in the common Centre, muſt always there remain.

As to the leaking of the Water through this Shell, when once a paſſage ſhall be found for it to run through, I muſt confeſs it is an Objection ſeemingly of weight; but when we conſider how tightly great Beds of Chalk or Clay, and much more Stone do hold water, and even Caves arch'd with Sand; no man can doubt but the Wiſdom of the Creator has provided for the Macrocoſm by many more ways than I can either imagine or expreſs, eſpecially ſince we ſee the admirable and innumerable Contrivances wherewith each worthleſs Individual is furniſht both to defend it ſelf and propagate its Species. What Curioſity in the Structure, what Accuracy in the Mixture and Compoſition of the parts ought not we to expect in the Fabrick of this Globe, made to be the laſting Habitation of ſo many various Species of Animals, in each of which there want not many Inſtances that manifeſt the boundleſs Power and Goodneſs of their Divine Author; and can we then think it a hard ſuppoſition that the Internal parts of this Bubble of Earth ſhould be replete with ſuch Saline and Vitriolick Particles as may contribute to petrifaction, and diſpoſe the tranſuding Water to ſhoot and coagulate into Stone, ſo as continually to fortifie, and if need were to conſolidate any breach or flaw in the Concave Surface of the Shell.

And this perhaps may not without reaſon be ſuppoſed to be the final Cauſe of the admixture of the Magnetical Matter in the Maſs of the Terreſtrial parts of our Globe, *viz.* To make good and maintain the Concave Arch of this Shell: for by what the excellent Mr. *Newton* has ſhewn in his *Principia Philoſophiæ*, it will follow that according to the general Principle of Gravity, viſible throughout the whole Univerſe, all thoſe Particles that by length of time or otherwiſe ſhall molder away or become looſe on the Concave Surface of the External Sphere, would fall in, and with great force deſcend on the Internal, unleſs thoſe Particles were of another ſort of Matter capable by their ſtronger tendency to each other, to ſuſpend the force of Gravity; but we know no other ſubſtances capable of ſupporting each other by their mutual Attraction but the Magnetical, and theſe we ſee miraculouſly to perform that Office, even where the power of Gravity has its full effect, much more within the Globe where it is weaker. Why then may we not ſuppoſe theſe ſaid Arches to be lined throughout with a Magnetical Matter, or rather to be one great Concave Magnet, whoſe two Poles are the Poles we have before obſerved to be fixt in the Surface of our Globe.

Another Argument favouring this Hypotheſis is drawn from a Propoſition of the ſame Mr. *Newton*, where he determines the force wherewith the *Moon* moves the *Sea* in producing the *Tides*: his words are, *Denſitas Lunæ eſt ad denſitatem Terræ ut* 680 *ad* 387 *ſeu* 9 *ad* 5 *quamproxime. Eſt igitur corpus Lunæ denſius ac magis tereſtre* *quam Terra noſtra*, p. 466. Now if the Moon be more ſolid than the Earth as 9 to 5, why may we not reaſonably ſuppoſe the Moon, being a ſmall Body and a Secondary Planet, to be ſolid Earth, Water, and Stone, and this Globe to conſiſt of the ſame Materials, only four ninths thereof to be Cavity, within and between the internal Spheres: which I would render not improbable.

To thoſe that ſhall enquire of what uſe theſe included Globes can be, it muſt be allowed, that they can be of very little ſervice to the Inhabitants of this outward World, nor can the Sun be ſerviceable to them, either with his Light or Heat. But ſince it is now taken for granted that the Earth is one of the Planets, and they all are with reaſon ſuppoſed Habitable, though we are not able to define by what ſort of Animals; and ſince we ſee all the parts of the Creation abound with Animate Beings, as the Air with Birds and Flies, the Water with the numerous varieties of Fiſh, and the very Earth with Reptiles of ſo many ſorts; all whoſe ways of living would be to us incredible did not daily Experience teach us. Why then ſhould we think it ſtrange that the prodigious Maſs of Matter, whereof this Globe does conſiſt, ſhould be capable of ſome other improvement than barely to ſerve to ſupport its Surface? Why may not we rather ſuppoſe that the exceeding ſmall quantity of ſolid Matter in reſpect of the fluid Ether, is ſo diſpoſed by the Almighty Wiſdom as to yield as great a Surface for the uſe of living Creatures as can conſiſt with the conveniency and ſecurity of the whole. We our ſelves, in Cities where we are preſſed for room, commonly build many Stories one over the other, and thereby accommodate a much greater multitude of Inhabitants.

But ſtill it will be ſaid that without Light there can be no living, and therefore all this *apparatus* of our inward Globes muſt be uſeleſs: to this I anſwer that there are many ways of producing Light which we are wholly ignorant of; the Medium it ſelf may be alwaies luminous after the manner of our *Ignes fatui*. The Concave Arches may in ſeveral places ſhine with ſuch a ſubſtance as inveſts the Surface of the Sun; nor can we, without a boldneſs unbecoming a Philoſopher, adventure to aſſert the impoſſibility of peculiar Luminaries below, of which we have no ſort of *Idea*. I am ſure the Poets *Virgil* and *Claudian* have gone before me in this Thought, inlightning their *Elyſian Fields* with Sun and Stars proper to thoſe infernal, or rather internal, Regions. Virg. Æneid. 6.

Largior hic compos æther & lumine veſtit
Purpureo; Solemque ſuum ſua Sidera norunt.

And *Claudian* lib. 2. *De Raptu Proſerpinæ.*

Amiſſum ne crede diem, ſunt altera nobis
Sidera, ſunt orbes alii, lumenque videbis
Purius, Elyſiumque magis mirabere Solem.

And though this be not to be eſteemed as an Argument, yet I may take the liberty I ſee others do, to quote the Poets when it makes for my purpoſe.

Laſtly, To explain yet farther what I mean, I have adventured to adjoyn the following Scheme, wherein the Earth is repreſented by the outward Circle, and the three inward Circles are made nearly proportionable to the Magnitudes of the Planets *Venus*, *Mars* and *Mercury*, all which may be included within this Globe of Earth, and all the Arches more than ſufficiently ſtrong to bear their weight. The Concave of each Arch, which is ſhaded differently from the reſt, I ſuppoſe to be made up of Magnetical Matter; and the whole to turn about the ſame common Axis *p*, *p*. only with this difference, that the Outer Sphere ſtill moves ſomewhat faſter than the Inner. Thus the Diameter of the Earth being about eight thouſand *Engliſh* Miles, I allow five hundred Miles for the thickneſs of its Shell, and another ſpace of five hundred Miles for a Medium between, capable of an immenſe Atmoſphere for the Uſe of the Globe of *Venus*: *Venus* again I give a Shell of the ſame thickneſs, and leave as great a ſpace between her Concave and *Mars*; ſo likewiſe from *Mars* to *Mercury*, which latter Ball we will ſuppoſe ſolid,and about two thouſand Miles Diameter. Thus I have ſhewed a poſſibility of a much more ample Creation, than has hitherto been imagined; and if this ſeem ſtrange to thoſe that are unacquainted with the Magnetical Syſtem, it is hoped that all ſuch will endeavour firſt to inform themſelves of the Matter of Fact, and then try if they can find out a more ſimple Hypotheſis, at leaſt a leſs abſurd, even in there own Opinions. And whereas I have adventured to make theſe Subterraneous Orbs capable of being inhabited, 'twas done deſignedly for the ſake of thoſe who will be apt to ask *cui bono*, and with whom Arguments drawn from *Final Cauſes* prevail much. If this ſhort Eſſay ſhall find a kind acceptance, I ſhall be encouraged to enquire farther, and to Poliſh this rough Draft of a Notion till hitherto not ſo much as ſtarted in the World, and of which we could have no Intimation from any other of the *Phænomena* of Nature.

Since this was written, a Diſcovery I have made in the Celeſtial Motions, ſeems to render a farther account of the Uſe of the Cavity of the Earth, *viz.* To diminiſh the Specifick Gravity thereof in reſpect of the Moon: for I think I can demonſtrate that the Oppoſition of the Ether to the Motions of the Planets in long time becomes ſenſible: and conſequently the greater Body muſt receive a leſs Oppoſition than the ſmaller, unleſs the Specifick Gravity of the ſmaller do proportionably exceed that of the greater, in which caſe only they can move together; ſo that the Cavity I aſſign in the Earth, may well ſerve to adjuſt its weight to that of the Moon. For otherwiſe the Earth would leave the Moon behind it, and ſhe become another Primary Planet. But this I deſign to explain by a Diſcourſe apart more at large.

FINIS.

BRITISH MUSEUM NATURAL HISTORY.

Philos. Transact. N°. 196.

Fig: 1.

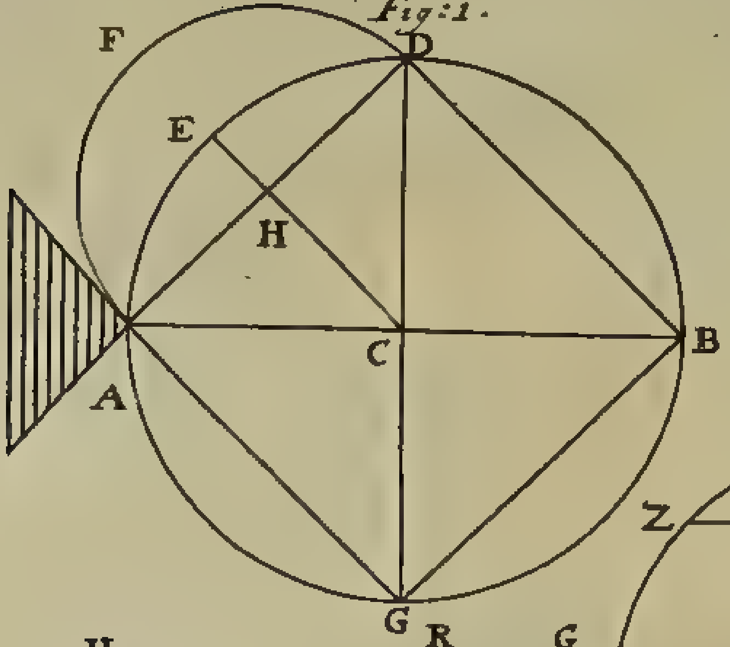


Fig: 2.

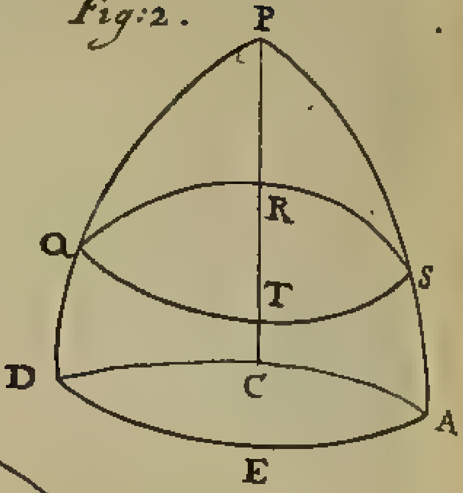
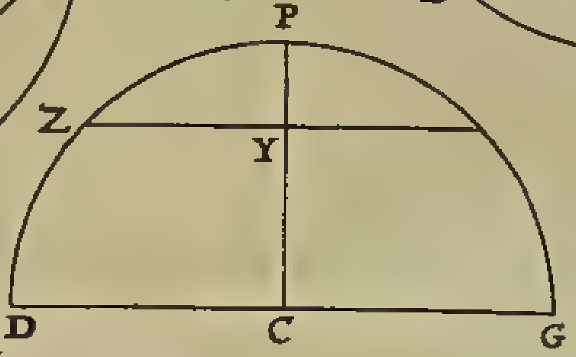


Fig: 3.



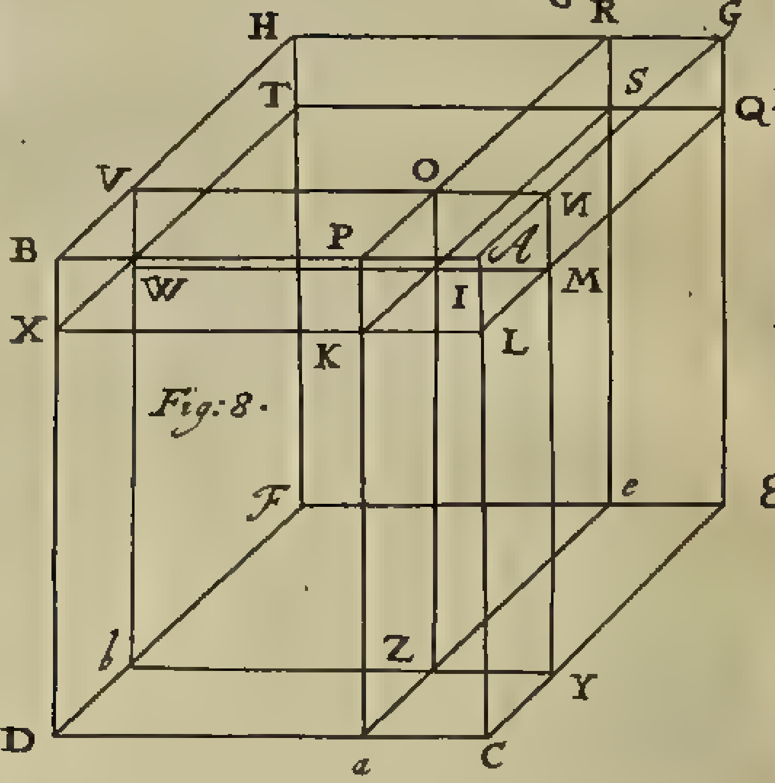


Fig: 8.

Fig: 6.

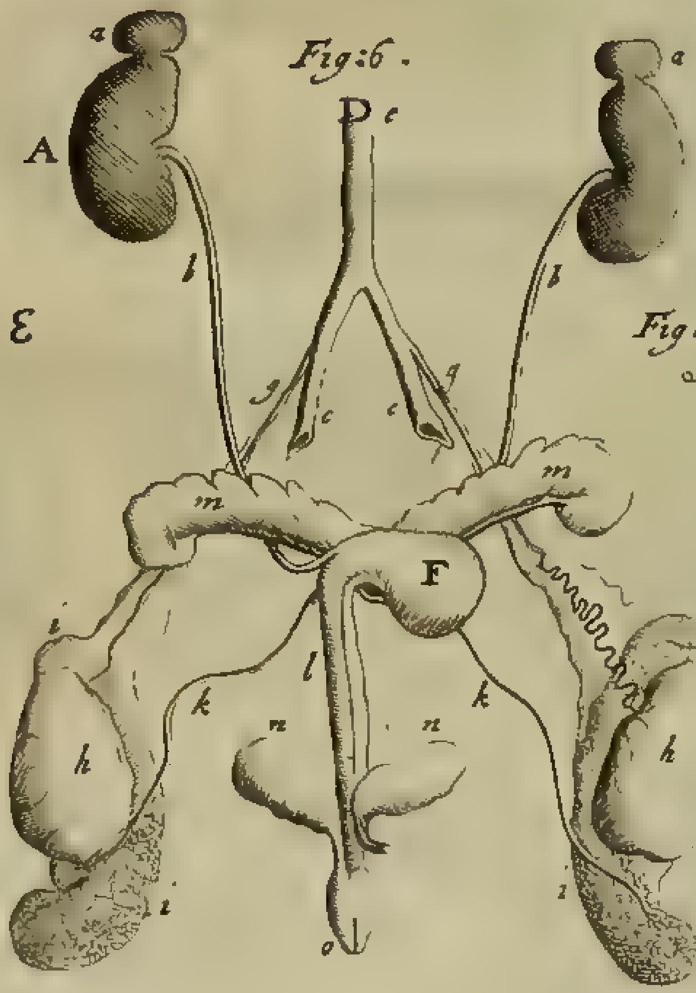
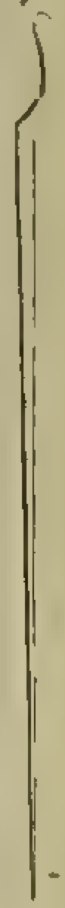


Fig: 5.

Fig: 4.



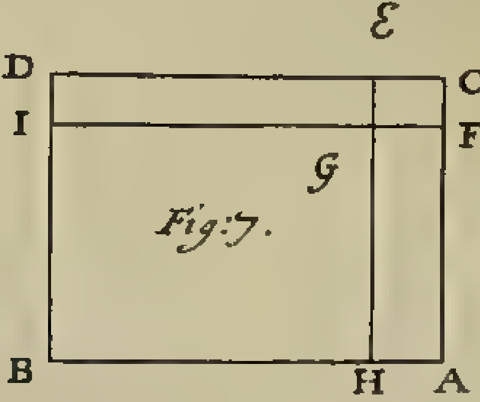


Fig: 7.

Numb. 196.

PHILOSOPHICAL TRANSACTIONS.

For the Month of January, 169$\frac{2}{3}$.

The CONTENTS.

1. THE Preface. 2. *A Paper of the Honourable* Robert Boyle, *late Fellow of the Royal Society, depoſited with the Secretaries of the R. S.* A°. 1680. *containing a Method of preparing the* Phoſphorus *of Humane Urine.* 3. *A Solution of the* Florentine Problem *touching the Figure of a* Cupola, *whoſe Windows being cut out, the Remainder is Quadrable. By the Reverend* John Wallis, S. T.D. 4. *The Extract of two Letters from Mr.* Anth. Leeuwenhoek *of* Delft *about the* Teſticles *of a* Rat, *and the* Animalcules *therein contained; with ſome Obſervations of* Small Animals *found in* Oyſters, *and in the Sap of* Vines. 5. *Some Obſervations in the diſſection of a* Rat, *with a Figure of the* Genital *parts thereof. By Mr.* Ric Waller, *S. R. Secr.* 5. *An Eſtimate of the Degrees of the* Mortality *of* Mankind *drawn from curious Tables of the Births and Funerals at the City of* Breſlaw, *with an Attempt to aſcertain the*

Price of Annuities *upon Lives. By Mr.* Edmond Halley, *R. S. S.*

An Account of BOOKS.

1. THE WISDOM OF GOD *manifeſted in the Works of the Creation: In Two Parts. The Second Edition, very much enlarged. By* John Ray, *S. R. S. in* 8°. 1692.

2. *Three* Phyſico-Theological *Diſcourſes, concerning* 1. *The Primitive Chaos and Creation of the World.* 2. *The General Deluge, its Cauſes and Effects.* 3. *The Diſſolution of the World, and future Conflagration, in* 8°. 1693. *Both Printed for* S. Smith.

3. Leonardi Plukenetii Phytographia, ſive ſtirpium illuſtriorum Icones. Pars Tertia. *Lond. In* Folio. 1693. *Printed for the Author, and Sold by* S. Smith.

THE PREFACE.

S O many and ſo large Steps having been made towards the Diſcovery of Nature *by the indefatigable Induſtry of this* laſt Age, *it may ſeem as if the Subject were almoſt exhauſted, and* Nature *her ſelf wearied with the Courtſhips of ſo many* Pretenders : *But if on the other ſide, we conſider the vaſt, not to ſay* boundleſs Extent *of the* Univerſe, *and that the Diſcovery of one* Phænomenon *leads to, as well as entices to the Search after another ; together with how eaſie a thing it is, even to impoſe on our ſelves* groundleſs Opinions *inſtead of* Real Knowledge ; *we muſt own the Work at leaſt great enough for the* Age *of the* World, *and ſooner doubt our own Reſolutions and Abilities, than fear the Failure of fit* Subjects *to entertain our Thoughts.*

Real Knowledge *is a nice thing ; and as no Man can be ſaid to be* Maſter *of that which he cannot teach to another, ſo neither can the* Mind *it ſelf, at leaſt as to* Phyſical *matters, be allowed to apprehend that whereof it has not in ſome ſence a* Mechanical Conception ; *for this* Knowledge *entring wholly by the Senſes, whoſe Objects only are* Bodies, *whereof their* Organs *have the Perception, but from the* Magnitude, Figure, Situation *and* Motion *of them, which are all* mechanically *to be conſider'd, or we come ſhort of a* Satisfactory Information, *it follows, that* Number, Weight *and* Meaſure *muſt be* *applied to annalize the Problems of Nature by which they were compounded.*

This has been the Employment *of the* Experimenting *part of Mankind, and the* Deſign *of that* Glorious Inſtitution *of the* Royal Socity ; *whoſe Youthful Vigour carried them warmly on in the purſuit of* Nature, *then at a farther diſtance off ; catcht and graſp'd the* Proteus *thro' all its Changes. And ſince* Publications *of this* Nature *have been thought no ſmall Advancement to that great* Deſign, *becauſe it collects and preſerves ſeveral* ſmall Tracts, *which otherwiſe might poſſibly be loſt, the* Publiſher *has yielded to the Sollicitation of ſome Friends to undertake this* Work *with an* Engagement *to the* Learned, *of communicating (as conſtantly as hath ever been at any time practiſed) whatever of a* Philoſophical Nature *ſhall come to his hands, clearing the* Royal Society, (*which is no way concerned therein*) *from all the* Miſcarriages *he may poſſible commit ; and promiſes himſelf he ſhall never fail of* Materials *from the* Ingenious, *ſince he propoſes neither the mean end of* private Advantage, *nor thinks himſelf capable of the* Baſeneſs, *to ſtifle any Perſons* Diſcovery *till another may pretend to it ; being reſolved immediately to inſert in the next Tranſaction what ingenious Communications ſhall be ſo deſired, that the true Author be not defrauded of his due* Merit *and* Glory.

I. *A Paper of the Honourable* Robert Boyl'*s*, *depoſited with the Secretaries of the Royal Society*, Octob. 14. 1680. *and opened ſince his Death; being an Account of his making the* Phoſphorus, *&c.*

Sept. 30. 1680. THere was taken a *conſiderable quantity* of *Man's Urine*, (becauſe the Liquor yields but a ſmall proportion of the deſired *Quinteſſence*) and of this a good part at leaſt, had been for a pretty while digeſted before it was uſed. Then this Liquor was diſtilled with a moderate Heat, till the *Spirituous* and *Saline* parts were drawn off; after which the *Superfluous* Moiſture alſo was abſtracted (or evaporated away) till the remaining Subſtance was brought to the conſiſtence of a ſomewhat thick *Syrup*, or a thin *Extract*. This done, it was well incorporated with thrice its Weight of fine *White Sand*; and the Mixture being put into a ſtrong Stone-*Retort*, to which a large *Receiver* (in good part fill'd with Water) was ſo joyn'd, that the Noſe of the Retort did almoſt touch the Water: Then the two Veſſels being carefully luted together, a naked Fire was gradually adminiſtred for Five or Six Hours, that all that was either *Phlegmatick* or *Volatile* might come over firſt. When this was done, the Fire was encreaſed, and at length for Five or or Six Hours made as ſtrong and intenſe as the Furnace (which was not bad) was capable of giving: (which Violence of Fire is a Circumſtance not to be omitted in this Operation.) By this means there came over good ſtore of white Fumes, almoſt like thoſe that appear in the Diſtillation of the Oyl of *Vitriol*; and when thoſe Fumes were paſs'd, and the *Receiver* grew clear, they were after a while ſucceeded by another ſort that ſeem'd in the *Receiver* to give a faint blewiſh Light, almoſt like that of little burning Matches dipt in Sulphur. And laſt of all, the Fire being very vehement, there paſs'd over another Subſtance, that was judg'd more ponderous than the former, becauſe it fell through the Water to the bottom of the *Receiver*; whence being taken out, (and partly even whilſt it ſtay'd there, it) appeared by ſeveral Effects, and other *Phænomena*, to be ſuch a kind of Subſtance as we deſired and expected.

II. *Problema* Florentinnm, *de mira Templi Teſtudine Quadrabili. A Doctiſſimo Dn°. Johanne Wallis, S. T. D. Solutum.*

Libet hic ſubjungere, Problema quoddam (interventu Clariſſimi Viri *D. Guilielmi Bridgman*) ad me tranſmiſſum, de mira cujuſdam Templi Teſtudine Quadrabili, meamque ejuſdem Solutionem, cum ſubjuncto Scholio eam explicante.

D. *Guilielmi Bridgman* ad me Epiſtola, erat (Latine reddita) ad hunc ſenſum;

Reverendo Viro, D. Wallis *S. T. D. Geometriæ Profeſſori*, Oxonii.

Auguſti 30. 1692.

Incluſam churtulam (Reverende Vir) Florentia *mihi miſſam, ut ad te deferatur (de qua ſententiam tuam expetunt*

tunt) cum his accipies. Cui ſi tibi viſum fuerit reſponſi aliquid reponere, id ego curabo Florentiam *remittendum.*

Tuus ad officia,

Guilielmus Bridgeman.

Incluſa chartula, hæc erat.

Die 4. *April.* 1692.

“ ÆNIGMA GEOMETRICUM
“ DE MIRO OPIFICIO TESTUDINIS
“ QUADRABILIS HEMISPHÆRICÆ
“ A
“ D. PIO LISCI PUSILLO GEOMETRA

“ Propoſitum.

“ *Cujus Divinatio, à ſecretis Artibus Illuſtrium Ana-*
“ *lyſtarum vigentis ævi expectatur, quod, in Geometriæ*
“ *pura hiſtoria tantummodo verſatus, ad tam recondita*
“ *videatur invalidus.*

“ INter venerabilia eruditæ olim Græciæ monumen-
“ ta, extat adhuc, perpetuo equidem duraturum,
“ Templum auguſtiſſimum, ichnographia Circulari,
“ ALMÆ GEOMETRIÆ dicatum, quod, à Teſtudine
“ intus perfecte hemiſphærica, operitur: ſed in hac,
“ feneſtrarum quatuor æquales areæ (circum, & ſupra
“ baſim hemiſphæræ ipſius diſpoſitarum) tali configura-
“ tione, amplitudine, tantaque induſtria, ac ingenii acu-
“ mine ſunt extructæ, ut, his detractis, ſuperſtes curva
“ Teſtudinis ſuperficies, pretioſo opere muſivo ornata,
“ Tetragoniſmi verè Geometrici eſt capax.

“ Quæritur modo, quæ ſit, qua methodo, quave
“ arte, pars illa hemiſphæricæ ſuperficiei curvæ quadra-

“ bilis, tenſæ ad inſtar Carbaſi, vel turgidi Veli nautici,
“ ab Architecto illo Geometra fuerit aſſecuta ? & cui de-
“ mum plano geometrice quadribili ſit æqualis.

“ PRæſentis Ænigmatis enodatio (quod ſpectat ad
“ hujus admirabilis Fornicis, tum Conſtructio-
“ nem expeditiſſimam, tum Quadraturam) SERENIS-
“ SIMO FERDINANDO MAGNO PRINCIPI ETRU-
“ RIÆ, Scientiarum, & nobiliorum Artium CULTO-
“ RI, ac PATRONO GENEROSISSIMO, ab eodem
“ Ænigmatiſta collata jam eſt ; qui quidem ſimul non
“ dubitat quin hoc ipſum Ænigma à ſingulis, literario in
“ Orbe degentibus hodie, præclariſſimis Analyſtis, ſit
“ ſtatim divinaturum, proprias quadrationes impertien-
“ do ſingularis Teſtudinis hujus tetragoniſmicæ ac hemi-
“ ſpæra diſſectæ : ſed ipſorum ſolummodo peracutas
“ indagines, multipliceſque induſtrias ad hoc unum, i-
“ demque Geometricum collimantes, impatientur expe-
“ ctat, ut hinc, qui temere contumelias in Geometriam
“ jacere audent, ſilere diſcant ; vel potius maxima cum
“ voce exclament. OH UNICA VERORUM SCIS-
“ CITABILIUM SCIENTIA à DIVINA in Hominem
“ MENTE infuſa,ut hæc, imperviis, mutabilibus, fallaci-
“ buſque contemptis, æterna iſta, quæ ſemper, & uni-
“ cuique ſunt eadem, tantum appetat, nilque aliud un-
“ quam magis innocuum ſcire perquirat.

Cui ſic reſponſum eſt.

Clariſſimo Viro, **D.** Guilielmo Pontio, *Anglice* Bridgeman, Johannes Wallis. *S.*

Oxoniæ, *Sept.* 2. 1692.

Accepi, Vir Clariſſime, nudius tertius (noctu decubiturus) Literas tuas pridie datas Londini *(Auguſti* 30. *ſera nocte;) quibus heri non vacabat, alias occupato, reſpondere: Eiſque incluſam Chartulam, typis impreſſam, cui aſſcriptus eſt dies* 4 April 1692. *Quam ais* Florentia *te accepiſſe mihi mittendam. Cui reſponſum meum expetis, quod* Florentiam *te remiſſurum polliceris.*

Continet ea Chartula Ænigma Geometricum, *quod (verborum involucris exemptum) hoc innuere judico Problema;* Ab Hemiſphærii curva ſuperficie, Segmenta quatuor inter ſe æqualia ſic amputare, ut reliquum ſit Tetragoniſmi capax.

Simulque videtur innuere, In veteris Græciæ *monumentis etiamnum extare quidpiam quo illud fiat.*

Hoc eſſe exiſtimo Hippocratis *Chii* Quadraturam Lunulæ.

Quippe cum Archimedes *demonſtravit,* Curvam Hemiſphærii ſuperficiem æqualem duobus Circulis ejuſdem Spæræ maximis, (*id eſt* quatuor Semicirculis;) *Docuitque* Hippocrates *Chius* Lunulam quadrare *quandam: Si ſingulis Hemiſphærici hujuſce Fornicis quadrantibus, tantundem eximatur, quanto deficit à Semicirculo ea Lunula; Reliquum æquabitur Quadrato, quod Circulo Sphæræ maximo (cui hic inſiſtit Fornix Hemiſphæricus) inſcribatur.*

Sic habes, Vir Clariſſime, tum Ænigmatis *Enodationem, tum Solutionem Problematis.*

Si tamen, præter Ænigmaticam Problematis involutionem, ſubſit aliquid (de Templo) Hiſtoricum: putaverim ego, S. Sophiæ (*quod eſt* Conſtantinopoli) *Templum hic inſinuatum.*

SCOLIUM.

Per *Hippocrates* Chii *Quadraturam Lunulæ* (1° Phyſi- Fig. 1. corum *Ariſtotelis*, & *Simplicii* in eum locum Commentariis, indicatam,) Si ſemicirculo A B D, in duos quadrantes A C D B C D deviſo, aptetur A D ſubtenſa quadrantalis arcus, radio C E biſecta in H: & centro H ſcribatur ſemicirculus A D F: Erit (propter quadratum rectæ A D ſubduplum quadrati rectæ A B) ſemicirculus A D F ſubduplus ſemicirculi A B D; adeoque quadranti A C D æqualis. Et (dempto utrinque communi ſegmento A D E) reſidua Lunula A E D F reſiduo Triangulo ADC æqualis. Taleſque quatuor Lunulæ, talibus quatuor Triangulis; hoc eſt, Quadrato toti circulo inſcripto ADBG.

Porro; per *Archimedis* demonſtrata; Æquatur Sphæræ ſuperficies, quatuor Circulis in ea Sphæra Maximis. Adeoque Hemiſphærii ſuperficies curva, talibus quatuor Semicirculis: taliſque ſuperficiei Hemiſphæricæ Quadrans, uni ſemicirculo.

Circulus ADBG eſto jam Baſis Hemiſphæricæ ſuperficiei curvæ: cujus polus P, axis C P, plano baſis per- Fig. 2. pendicularis, ejuſque quadrans unus D P A; qui plano EPC per axem tranſeunte biſecetur.

Ponantur item (ob commodiorem calculum) Circuli radius R, diameter $D = 2R$, peripheria P, expoſitus arcus a, Poſitoque quadrantali arcu DEA $=a=\frac{1}{4}P$; eſt ſemicirculus ABD $=aR=\frac{1}{4}RP$: triangulum ADC$=\frac{1}{2}R^2=\frac{1}{4}RD$; reliquumque ſemicirculi (dempto hoc triangulo) $\frac{1}{4}RP-\frac{1}{4}RD$; cui æquale auferendum eſt ex DPA (quadrante ſuperficiei hemiſphæricæ curvæ, æquali ſemicirculo ABD) quo reſiduum æquetur expoſito triangulo ADC.

Quod quum variis modis fieri poſſit; per ea quæ nos dudum docuimus Anno 1659. (ad calcem Tractatus de *Cycloide*, tum Editi, pag. 122. inſerenda ad § 68) iterumque Anno 1670 (in Tractatus *de Motu* capite V, prop. 24.) de *Figura Plana, æquali cuivis in ſuperficie Spærica figuræ, circulis quibuſvis (ſive maximis, ſive minoribus) terminatæ.* Sic fiat ſimpliciſſime;

Cum ſuperficiei Sphæricæ ſegmenta, parallelis planis abſciſſa, ſint Axis ſegmentis proportionalia (quod de expoſita quadrantalis Cunei ſuperficie DPA pariter valet:) Si ſumatur, in axe CP, ut ſemicirculus $\frac{1}{4}RP$, ad ſemicirculum dempto triangulo $\frac{1}{4}RP-\frac{1}{4}RD$; hoc eſt, ut P ad $P-D$; ſic CP ad CY: (ſive, quod tantundem eſt, ut P ad D, ſic CP ad PY:) planum per YZ baſi parellelum, abſcindet hujus ſuperficiei curvæ portionem polo adjacentem, æqualem triangulo ADC. Quod cum, in reliquis ſuperficiei curvæ quadrantibus, pariter fiat: æquabitur totum Abſciſſum (Polo adjacens) toti quadrato baſi inſcripto: Et ſic tenſum ut opportuit. Quod erat faciendum. Fig. 2.

Vel ſic brevius. Eſt Hemiſphærii ſuperficies curva (utpote duobus circulis maximis æqualis) $=RP$. Quadratum circulo maximo inſcriptum, $=2RR=RD$. Illudque ad hoc, ut P ad D. Adeoque (propter ſegmenta ſuperficiei parallelis planis abſciſſa, ſegmentis axis proportionalia) ſumptis CP ad PY ut P ad D, erit tum tota ſuperficies $=RP$, tum portio ad Polum, plano ZY abſciſſa, $=RD$ quadrato baſi inſcripto. Quod erat faciendum.

Si dicatur; Proceſſum hic eſſe ex præſumpti Circuli Quadratura, aut ratione quam habet circuli Perimeter ad Diametrum: Id omnino verum eſt. Sed non eſt objiciendum. Quia non poſtulat *Ænigma* propoſitum, ut Hemiſphæricæ ſuperficiei portiones *Abſciſſæ*, (quas *Feneſtras* vocat) ſed ut portio *Superſtes*, ſit Tetragoniſmi capax. Et quidem ſi utrumque poſtularet, poſtularet Circuli quadraturam abſolute Geometricam: quod haberi non poſſe ſatis conſtat.

Opificium quod ſpectat; ſuper baſem planam, extra baſem Hemiſphærii poſitam, ſed ipſi contiguam; cujus duo latera in angulum coeant ad A, intra protractas DA GA rectas, (quo *Feneſtrarum* quas vocat utrinque adjacentium liber proſpectus pateat, non impeditus,) extruatur Moles ſatis firma; ita quidam ut, aſſurgente ſtructura, promineat ejus Acies, angulo ſuffulta, circuli arcum efficiens qualis eſt DZ, ad altitudinem Y aſſurgens. Et ſimiliter ad reliquos angulos DBG. Atque his demum ſtructuris (quaſi totidem Columnis) ad eam altitudinem provectis, imponatur Teſtudo, ſic intus excavata ut poſcit Hemiſphærica ſuperficies. Adeoque totum opus imperatum obſolvitur. Fig. 2.

ALITER.

Idem fiet ſi, pro Quadrato baſi inſcripto, exponatur Quadratum quodvis QQ, (quod minus ſit quam Hemiſphærica ſuperficies curva.) Quippe ſi ſumatur, ut RP (hemiſphærica ſuperficies curva) ad QQ (expoſitum Quadratum,) ſic CP (axis hemiſphærii) ad PY (axis portionem polo adjacentem;) planum ZY (baſi parallelum) abſcindet portionem ſuperficiæi ſphæricæ Tetragoniſmi capacem: Utpote æqualem expoſito quadrato QQ.

ALITER

ALITER.

Idem ſic aliter abſolvi poteſt ; ſed majore ſolicitudine.

Cum ſit (ut jam oſtenſum eſt) Hemiſphæricæ ſuperficiei curvæ Quadrans DPA, æqualis Semicirculo ABD ; ejuſque ſegmenta planis baſi parallelis abſciſſa, ſegmentis Axis proportionalia: Sumatur in DP quadrantali arcu, arcus PQ graduum 60 ; (quod mihi *Caſwellus* ſuggerit.) Fig. 2. Polo P deſcriptus Circulus QTS biſecabit Axem (propter ſinum verſum grad. 60. $=\frac{1}{2}R$:) adeoque quadrantem hemiſphæricæ ſuperficiei curvæ DPA dirimet in duo ſegmenta inter ſe æqualia. Quorum alterum, DQTSA quadrilinium, æquat quadrantem circularem BCD ; reliquumque Trilineum PQTS æquat quadrantem ACD. Unde ſi porro auferatur QRST bilineum, æquale ſegmento circuli ADE : reliquum trilineum PQRS, æquabat ADC triangulum. Taliaque quatuor, in quatuor Quadrantibus Hemiſphærii, æquabunt Quadratum baſi inſcriptum. Habebitur autum illud Bilineum per ea quæ nos dudum docuimus locis modo citatis.

Idem univerſalius ſic fiet:

Sumpto Q ubivis in arcu DZ (ne major ſit DQ quam DZ ;) Et, Quanto deficit quadrilineum DQTSA à toto auferendo, tantundem ſuppleat Bilineum QRST : Reliquum æquabit ADC triangulum.

Et quidem, ſi ſumatur Q in D (quo evaneſcat Quadrilineum) ſumendum erit Bilineum æquale toti auferendo. Sin ſumatur Q in Z (ut Bilineo non ſit opus) æquabitur Quadrilineum toti auferendo.

Eademque omnia (de Quadrilineo & Bilineo quæ ſimul compleant totum auferendum) pariter accommodanda erunt (mutatis mutandis) ſi, pro Quadrato baſi inſcripto, ſubſtituatur Q Q quadratum quodvis; quod tota ſuperficie curva hemiſphærica non ſit majus.

Sed quum proceſſus hic (de bilineo ſumendo) ſit paulo operoſior; ſufficit ſimpliciorem praxin adhibuiſſe.

MONITUM.

Poſtquam hæc ſcripta fuerant, erantque ſub prelo, reſcivi tandem huic idem Problemati reſponſum dediſſe Cl. Virum D. *Leibnitz*, illudq; in *Actis Lipſicis* comparere pro Menſe *Junio* 1692. Quod fecit ut prelum ſufflaminandum curaverim per aliquot ſeptimanas donec illud conſpicerem; quod ægre tandem obtinui (nam apud Bibliopolas noſtros liber non eſtabat) exeunte *Decembri* noſtro. Videoque Cl. Virum juxta mecum ſentire, non eſſe *Problema Determinatum*, ſed mille modis (nedum infinitis) ſolubile. Methodum ejus non repeto. Quam ibi quærat Lector, ut utramque ſi libet conferat. Citat ille ſuam *Geometriam Incomparabilium*, & *Analyſin Infinitorum*, in *Actis Eruditorum* exſtantes; ſed quas ego nondum vidi (nam eorum libri ſero ad nos perveniunt) nec tamen inde minus æſtimo; ſed tanto Viro dignas præſumo. Et quidem, ſi tempori vidiſſem, potuiſſem cum *Newtoni* & *Gregorii* methodis (his forte non abſimiles) noſtris inſeruiſſe. Sed, cum alibi exſtent, id minus erit opus. Eſt ejus Solutio Problematis (ſatis ingenioſa) ex comparatis ſuperficiebus Sphærica & Cylindrica, atque Ungularum Doctrina (quas & nos alibi tractavimus) petita; & ſecundum *Indiviſibilium* methodum demonſtrata; (aliis interim adhibitis lineis quam Circularibus;) eodem die præſtita (ut in re non admodum difficili) quo acceperit Problema. Nec in Problemate requiri exiſtimat (uti nec ego) ut partes *Abſciſſæ* ſed ſaltem ut pars *Reſidua* ſit Quadrabilis.

IV. *The*

IV. *The Abſtract of two Letters ſent ſome time ſince by Mr.* Anth. Van. Leeuwenhoeek *to* Dr. Gale *and Dr*. Hooke.

HAving examined the *Teſticles* of a *Rat*, and the Liquor preſs'd out of the Seminal Veſſels thereof, I found a great number of *Amalcules* long and ſerpent-like, as is repreſented *Fig.* 4. which ſhews one of them dead. The Liquor it ſelf in which they floated was tranſparent and oyly, full of irregular Parts, beſides the *Amalcules*, ſome whereof lay turned up round, and ſeemed not to be full grown or living ; and I conceived the irregular Particles were the Beginnings or Rudiments of theſe *Animalcules* which were generated in the Thred-like Veſſels of the *Teſticles.* I ſuppoſe the manner of their *Generation* differs from that of the Eels I have formerly obſerved in Vinegar, which carry their Young in their Body, whereas I believe theſe are produced from an Egg. And poſſibly they may have their beginning with the Generation of the Animal, and come to perfection together with it, remaining in the Seed in the *Teſticles* in *Fieri*, till the Animal it ſelf is fit for Copulation ; as in Man till about Fourteen Years, and then firſt have Life and Perfection.

The particular Coat of theſe *Thred-like Veſſels* is exceeding thin ; and the *Amalcules* therein contained ſo very minute, that 10000 of them equal not one *Thred* ; whence may be computed the vaſt number one *Teſticle* is capable of containing. Theſe *Threds* are more conſpicuous in the Teſticle of a *Rat* than any Animal.

Endeavouring to examine the *Seed* of *Muſcles* in *March* when they ſpawn, I was ſomewhat prevented ; only in the Liquor contained in their Shells, I found many ſmall living Animals; and the *Muſcle* it ſelf had two thin Films, conſiſting of long ſlender *Threds*, with little knobby parts thereon, ſomething like the Beards or Fins of *Oyſters*, but were more eaſily ſeparable from the Fiſh: Theſe Strings were thick beſet with Hairs continually moving; and through the *Threds* themſelves I ſaw a great number of ſmall *Animals*.

In the Liquor in *Oyſters* I found ſeveral ſorts of *Amalcules*, but in their Beards or Gills none, poſſibly becauſe the *Oyſters* were dead.

Examining the *Sap* that bleeds from *Vines*, I found therein ſeveral *Amalcules* of different ſizes, ſuch as I had formerly obſerved in Water. And I ſuppoſe that the Sun may have raiſed the very ſmall *Eggs* of theſe *Amalcules*, and let them fall in Dew or Rain on the outſides of Vines which ſtopt by the Leathers that faſten them to the Wall, are there hatch'd and carried down with the trickling Sap,which I am confirmed in, by reaſon after Rain I found of theſe *Amalcules* in the Water ſo ſtopt by the Leathers; and at other times I have found no *Amalcules* in the *Sap* of *Vines*.

I have ſometimes found in this *Sap* an *Aurelia*, ſuch as *Fig*. 5. but a Million of times ſmaller than a courſe Sand. Some of theſe I brought home, but thoſe in the Air dried up to nothing, and ſome that I kept in Water were loſt.

V. *Some* Obſervations *in the Diſſection of a* Ratt, *communicated by Mr.* R. W. *S.R.S.*

THE *Fore-Feet* of a *Rat* reſemble thoſe of the *Caſtor*. The *Hair* is alſo ſome Fine, ſome Courſe; as in that *Animal*. The *Tail ſcaly*, with Hairs between every Scale, like the *Caſtors*, which ſhews theſe two *Animals* to be ſomething a-kin; and indeed the *Water-Rat* comes very near to the *Beaver*, and makes it's Holes in the bank-ſides of Ponds after the ſame manner.

The *Penis* in the *Rat* has a particular Paſſage near the *Navel*, as in *Squirrels*; and not at the *Anus*, as in the *Caſtor*.

The *Liver* is full of little Specks as big as Pins Heads, which are the little *Glands* thereof.

There was no *Gall-Bladder*, but a *Ductus Felleus*; poſſibly the *Bladder* was incloſed in the *Parenchyma* of the *Liver*, as it is in ſome *Animals*.

The *Cæcum* was much larger than the *Stomach*, and in ſhape like that of the *Caſtor*.

The *Teſticles* lay not behind, but in the *Groins* on the *Os Pubis*. Theſe were like a *Bottom* or *Skein* of *Thred* rumpled up together, which was viſible through the Coats of the *Teſticle*. This *Thred* continued of near the ſame Size in the *Epididymides*, only towards the *Deferentia* it grew larger, as is ſeen in the Figure. It was tender, and not eaſie to be unravel'd, ſo that I could not draw out above Three Quarters of a Yard.

The *Proſtatæ* lay under the *Spermatic Arteries*.

The *Kidneys* were whitiſh with their *Succenturiati*, as in the *Figure* annext. At the Neck of the Bladder were inſerted the *Veſiculæ Seminales*, tranſparent and fill'd with the *Semen*.

Toward the End of the *Penis*, which had a *Bony Griſtle*, were two large *Glands*, emptying themſelves near the End of the *Penis*, and contained a Subſtance like *Cream*, as in the *Dormouſe*, obſerved by *Swammerdam*.

Figure the 6th *repreſents,*

A A, The Kidneys.

a a, The *Renes Succenturiati.*

b b, The *Ureters.*

c c, The Crural Veins and Arteries.

D, *Arteria Magna.*

e, *Vena Cava.*

F, The Bladder.

g g, The Spermatick Veſſels, Veins and Arteries.

h h, The *Teſtes*, with the Branches of the Veins and Arteries.

i i, The *Epididymides.*

k k, The *Deferentia.*

l, The *Penis.*

m m, *Veſiculæ Seminales.*

n n, Two Glands, from whence a thick Juyce might be preſs'd out.

o, The *Balanus.*

An Eſtimate of the Degrees of the Mortality *of Mankind, drawn from curious* Tables *of the* Births *and* Funerals *at the City of* Breſlaw ; *with an Attempt to aſcertain the Price of* Annuities *upon* Lives. *By Mr.* E. Halley, *R.S.S.*

THE Contemplation of the *Mortality* of *Mankind*, has beſides the *Moral*, its *Phyſical* and *Political* Uſes, both which have been ſome years ſince moſt judiciouſly conſidered by the curious Sir *William Petty*, in his *Natural* and *Political* Obſervations on the Bills of *Mortality* of *London*, owned by Captain *John Graunt*. And ſince in a like Treatiſe on the Bills of *Mortality* of *Dublin.*

Dublin. But the Deduction from thoſe Bills of *Mortality* ſeemed even to their Authors to be defective: Firſt, In that the *Number* of the People was wanting. Secondly, That the *Ages* of the People dying was not to be had. And Laſtly, That both *London* and *Dublin* by reaſon of the great and caſual Acceſſion of *Strangers* who die therein,(as appeared in both, by the great Exceſs of the *Funerals* above the *Births*) rendred them incapable of being Standards for this purpoſe; which requires, if it were poſſible, that the People we treat of ſhould not at all be changed, but die where they were born, without any Adventitious Increaſe from Abroad, or Decay by Migration elſewhere.

This *Defect* ſeems in a great meaſure to be ſatisfied by the late curious Tables of the Bills of *Mortality* at the City of *Breſlaw*, lately communicated to this Honourable Society by Mr. *Juſtell*, wherein both the *Ages* and *Sexes* of all that die are monthly delivered, and compared with the number of the *Births*, for Five Years laſt paſt, *viz.* 1687, 88, 89, 90, 91, ſeeming to be done with all the Exactneſs and Sincerity poſſible.

This City of *Breſlaw* is the Capital City of the Province of *Sileſia*; or, as the *Germans* call it, *Schleſia*, and is ſcituated on the Weſtern Bank of the River *Oder*, anciently called *Viadrus*; near the Confines of *Germany* and *Poland*, and very nigh the Latitude of *London*. It is very far from the Sea, and as much a *Mediterranean* Place as can be deſired, whence the Confluence of Strangers is but ſmall, and the Manufacture of Linnen employs chiefly the poor People of the place, as well as of the Country round about; whence comes that ſort of Linnen we uſually call your *Scleſie Linnen*; which is the chief, if not the only Merchandize of the place. For theſe Reaſons the People of this City ſeem moſt proper for a *Standard* ; and the rather, for that the *Births* do, a ſmall matter, exceed the *Funerals*. The only thing wanting is the Number of the whole People, which in ſome meaſure I have endeavoured to ſupply by compariſon of the *Mortality* of the People of all Ages, which I ſhall from the ſaid Bills trace out with all the Acuracy poſſible.

It appears that in the Five Years mentioned, *viz.* from 87 to 91 incluſive, there were *born* 6193 Perſons, and *buried* 5869 ; that is, born *per Annum* 1238, and *buried* 1174 ; whence an *Encreaſe* of the People may be argued of 64 *per Annum*, or of about a 20th part, which may perhaps be ballanced by the Levies for the *Emperor*'s Service in his Wars. But this being contingent, and the Births certain, I will ſuppoſe the People of *Breſlaw* to be encreaſed by 1238 *Births* annually. Of theſe it appears by the ſame Tables, that 348 do die *yearly* in the *firſt Year* of their *Age*, and that but 890 do arrive at a full *Years Age*; and likewiſe, that 198 do die in the *Five Years* between 1 and 6 compleat, taken at a *Medium* ; ſo that but 692 of the Perſons *born* do ſurvive *Six* whole *Years*. From this *Age* the Infants being arrived at ſome degree of Firmneſs, grow leſs and leſs *Mortal* ; and it appears that of the whole People of *Breſlaw* there die *yearly*, as in the following Table, wherein the upper Line ſhews the *Age*, and the next under it the *Number* of Perſons of that Age *dying yearly*.

7 . 8 9. . 14 . 18 . 21 . 27 . 28. . 35 .
11 .11. 6. 5½ . 2 . 3½ 5 6 4½ 6½ 9 . 8 . 7 . 7 .

36. 42 . 45 49 54 . 55 . 56 . 63
8 . 9½ 8 . 9 . 7 . 7 . 10 11 . 9 . 9 . 10 . 12

70 71 . 72 77 81 84 . 90 91 .
9½ 14 9 . 11 9½ 6 . 7 . 3 . 4 . 2 . 1 . 1 . 1 .

98 . 99 . 100.
0 . ⅕ . ⅗

And where no *Figure* is placed over, it is to be underſtood of thoſe that die between the Ages of the preceding and conſequent *Column.*

From this Table it is evident, that from the Age of 9 to about 25 there does not die above 6 *per Annum* of each *Age*, which is much about one *per Cent.* of thoſe that are of thoſe *Ages*: And whereas in the 14, 15, 16, 17 *Years* there appear to die much fewer, as 2 and 3½, yet that ſeems rather to be attributed to Chance, as are the other Irregularities in the Series of Ages, which would rectifie themſelves, were the number of Years much more conſiderable, as 20 inſtead of 5. And by our own Experience in *Chriſt-Church Hoſpital*, I am informed there die of the *Young Lads*, much about one *per Cent. per Annum*, they being of the foreſaid *Ages*. From 25 to 50 there ſeem to die from 7 to 8 and 9 *per Annum* of each Age; and after that to 70, they growing more *craſie*, though the number be much diminiſhed, yet the *Mortality encreaſes*, and there are found to die 10 or 11 of each Age *per Annum*: From thence the number of the *Living* being grown very ſmall, they gradually decline till there be none left to *die*; as may be ſeen at one View in the Table.

From theſe Conſiderations I have formed the *adjoyned Table*, whoſe Uſes are manifold, and give a more juſt *Idea* of the *State* and *Condition* of *Mankind*, than any thing yet extant that I know of. It exhibits the *Number* of *People* in the City of *Breſlaw* of all Ages, from the *Birth* to extream *Old Age*, and thereby ſhews the Chances of *Mortality* at all *Ages*, and likewiſe how to make a certain Eſtimate of the value of *Annuities* for *Lives*, which hitherto has been only done by an imaginary *Valuation*: Alſo the *Chances* that there are that a *Perſon* of any *Age* propoſed does live to any other *Age* given; with many more, as I ſhall hereafter ſhew. This *Table* does ſhew the *number* of *Perſons* that are living in the *Age* current annexed thereto, as follows:

Age. Curt.	Per-ſons.	Age. Curt.	Per-ſons	Age. Curt.	Per-ſons	Age. Curt.	Per-ſons	Age. Curt.	Per-ſons	Age. Curt.	Per-ſons
1	1000	8	680	15	628	22	586	29	539	36	481
2	855	9	670	16	622	23	579	30	531	37	472
3	798	10	661	17	616	24	573	31	523	38	463
4	760	11	653	18	610	25	567	32	515	39	454
5	732	12	646	19	604	26	560	33	507	40	445
6	710	13	640	20	598	27	553	34	499	41	436
7	692	14	634	21	592	28	546	35	490	42	427
Age. Curt	Per-ſons.	Age. Curt.	Per-ſons	Age. Curt.	Per-ſons	Age Curt	Per-ſons	Age. Curt.	Per-ſons	Age. Curt.	Per-ſons
43	417	50	346	57	272	64	202	71	131	78	58
44	407	51	335	58	262	65	192	72	120	79	49
45	397	52	324	59	252	66	182	73	109	80	41
46	387	53	313	60	242	67	172	74	98	81	34
47	377	54	302	61	232	68	162	75	88	82	28
48	367	55	292	62	222	69	152	76	78	83	23
49	357	56	282	63	212	70	142	77	68	84	20

Age.	Perſons.
7	5547
14	4584
21	4270
28	3964
35	3604
42	3178
49	2709
56	2194
63	1694
70	1204
77	692
84	253
100	107
	34000
Sum Total.	

Thus it appears, that the whole People of *Breſlaw* does conſiſt of 34000 *Souls*, being the Sum *Total* of the Perſons of all Ages in the *Table*: The firſt uſe hereof is to ſhew the Proportion of *Men* able to bear *Arms* in any *Multitude*, which are thoſe between 18 and 56, rather than 16 and 60; the one being generally too weak to bear the *Fatigues* of *War* and the Weight of *Arms*, and the other too craſie and infirm from *Age*, notwithſtanding particular Inſtances to the contrary. Under 18 from the *Table*, are found in this City 11997 Perſons, and 3950 above 56, which together make 15947. So that the Reſidue to 34000 being 18053 are Perſons between thoſe *Ages*. At leaſt one half thereof are Males, or 9027 : So that the whole Force this City can raiſe of *Fencible Men*, as the *Scotch* call them, is about 9000, or $\frac{9}{34}$, or ſomewhat more than a quarter of the *Number* of *Souls*, which may perhaps paſs for a Rule for all other places.

The *Second Vſe* of this Table is to ſhew the differing degrees of *Mortality*, or rather *Vitality* in all *Ages* ; for if the number of Perſons of any *Age* remaining after one year, be divided by the difference between that and the number of the Age propoſed, it ſhews the *odds* that there is, that a Perſon of that Age does not die in a *Year*. As for Inſtance, a Perſon of 25 *Years* of *Age* has the odds of 560 to 7 or 80 to 1, that he does not *die* in a *Year* : Becauſe that of 567, living of 25 years of Age, there do die no more than 7 in a *Year*, leaving 560 of 26 Years old.

So likewiſe for the *odds*, that any Perſon does not die before he attain any propoſed *Age*: Take the *number* of the remaining Perſons of the Age propoſed, and divide it by the difference between it and the number of thoſe of the *Age* of the Party propoſed; and that ſhews the *odds* there is between the Chances of the Party's living or dying. As for Inſtance ; What is the *odds* that a Man of 40 lives 7 Years : Take the number of Perſons of 47 years, which in the Table is 377, and ſubſtract it from the number of Perſons of 40 years, which is 445, and the *difference* is 68: Which ſhews that the *Perſons dying* in that 7 years are 68, and that it is 377 to 68 or $5\frac{1}{2}$ to 1, that a Man of 40 does live 7 Years. And the like for any other *number* of *Years*.

Uſe III. But if it be enquired at what number of *Years*, it is an even Lay that a Perſon of any *Age* ſhall die, this Table readily performs it: For if the *number* of Perſons *living* of the *Age* propoſed be *halfed*, it will be found by the *Table* at what Year the ſaid *number* is reduced to half by *Mortality*; and that is the Age, to which it is an even Wager, that a Perſon of the *Age* propoſed ſhall arrive before he *die*. As for Inſtance; A Perſon of 30 Years of *Age* is propoſed, the number of that Age is 531, the half thereof is 265, which number I find to be between 57 and 58 Years; ſo that a Man of 30 may reaſonably expect to live between 27 and 28 Years.

Uſe IV. By what has been ſaid, the *Price* of *Inſurance* upon *Lives* ought to be regulated, and the difference is diſcovered between the *price* of enſuring the *Life* of a *Man* of 20 and 50, for Example: it being 100 to 1 that a Man of 20 dies not in a year, and but 38 to 1 for a Man of 50 Years of Age.

Uſe V. On this depends the Valuation of *Annuities* upon *Lives*; for it is plain that the *Purchaſer* ought to pay for only ſuch a part of the value of the *Annuity*, as he has Chances that he is living; and this ought to be computed yearly, and the Sum of all thoſe yearly Values being added together, will amount to the value of the *Annuity* for the *Life* of the Perſon propoſed. Now the preſent value of Money payable after a term of years, at any given rate of Intereſt, either may be had from Tables already computed; or almoſt as compendiouſly, by the Table of Logarithms: For the Arithmetical Complement of the Logarithm of Unity and its yearly Intereſt (that is, of 1, 06 for Six *per Cent.* being 9, 974694.) being multiplied by the number of years propoſed, gives the preſent value of One Pound payable after the end of ſo many years. Then by the foregoing Propoſition, it will be as the number of Perſons living after that term of years, to the number dead; ſo are the Odds that any one Perſon is Alive or Dead. And by conſequence, as the Sum of both or the number of Perſons living of the Age firſt propoſed, to the number remaining after ſo many years, (both given by the Table) ſo the preſent value of the yearly Sum payable after the term propoſed, to the Sum which ought to be paid for the Chance the perſon has to enjoy ſuch an Annuity after ſo many Years. And this being repeated for every year of the perſons Life, the Sum of all the preſent Values of thoſe Chances is the true Value of the Annuity. This will without doubt appear to be a moſt laborious Calculation, but it being one of the principal Uſes of this Speculation, and having found ſome *Compendia* for the Work, I took the pains to compute the following Table, being the ſhort Reſult of a not ordinary number of Arithmetical Operations; It ſhews the Value of Annuities for every Fifth Year of Age, to the Seventieth, as follows.

Age.	Years Purchaſe.	Age.	Years Purchaſe.	Age.	Years Purchaſe.
1	10,28	25	12,27	50	9,21
5	13,40	30	11,72	55	8,51
10	13,44	35	11,12	60	7,60
15	13,33	40	10,57	65	6,54
20	12,78	45	9,91	70	5,32

This ſhews the great Advantage of putting Money into the preſent *Fund* lately granted to their Majeſties, giving 14 *per Cent. per Annum*, or at the rate of 7 years purchaſe for a Life; when young Lives, at the uſual rate of Intereſt, are worth above 13 years Purchaſe. It ſhews likewiſe the Advantage of young Lives over thoſe in Years; a Life of Ten Years being almoſt worth $13\frac{1}{2}$ years purchaſe, whereas one of 36 is worth but 11.

Uſe V. Two Lives are likewiſe valuable by the ſame Rule; for the number of Chances of each ſingle Life, found in the Table, being multiplied together, become the Chances of the Two Lives. And after any certain Term of Years, the Product of the two remaining Sums is the Chances that both the Perſons are living. The Product of the two Differences, being the numbers of the Dead of both Ages, are the Chances that both the Perſons are dead. And the two Products of the remaining Sums of the one Age multiplied by thoſe dead of the other, ſhew the Chances that there are that each Party ſurvives the other: Whence is derived the Rule to eſtimate the value of the Remainder of one Life after another. Now as the Product of the Two Numbers in the Table for the Two Ages propoſed, is to the difference between that Product and the Product of the two numbers of Perſons deceaſed in any ſpace of time, ſo is the value of a Sum of Money to be paid after ſo much time, to the value thereof under the Contingency of Mortality. And as the aforeſaid Product of the two Numbers anſwering to the Ages propoſed, to the Product of the Deceaſed of one Age multiplied by thoſe remaining alive of the other; So the Value of a Sum of Money to be paid after any time propoſed, to the value of the Chances that the one Party has that he ſurvives the other whoſe number of Deceaſed you made uſe of, in the ſecond Term of the proportion. This perhaps may be better underſtood, by putting N for the number of the younger Age, and n for that of the Elder; Y, y the deceaſed of both Ages reſpectively, and R, r for the Remainders; and $R + Y = N$ and $r + y = n$. Then ſhall $N n$ be the whole number of Chances; $N n - Y y$ be the Chances that one of the two Perſons is living, $Y y$ the Chances that they are both dead; $R y$ the Chances that the elder Perſon is dead and the younger living; and $r Y$ the Chances that the elder is living and the younger dead. Thus two Perſons of 18 and 35 are propoſed, and after 8 years theſe Chances are required. The Numbers for 18 and 35 are 610 and 490, and there are 50 of the Firſt Age dead in 8 years, and 73 of the Elder Age. There are in all 610 x 490 or 298900 Chances; of theſe there are 50 x 73 or 3650 that they are both dead. And as 298900, to 298900 $-$3650, or 295250: So is the preſent value of a Sum of Money to be paid after 8 years, to the preſent value of a Sum to be paid if either of the two live. And as 560 x 73, ſo are the Chances that the Elder is dead, leaving the Younger; and as 417 x 50, ſo are the Chances that the Younger is dead, leaving the Elder. Wherefore as 610 x 490 to 560 x 73, ſo is the preſent value of a Sum to be paid at eight years end, to the Sum to be paid for the Chance of the Youngers Survivance; and as 610 x 490 to 417 x 50, ſo is the ſame preſent value to the Sum to be paid for the Chance of the Elders Survivance.

This poſſibly may be yet better explained by expounding theſe Products by Rectangular Parallelograms, as in *Fig.* 7. wherein AB or CD repreſents the number of perſons of the younger Age, and DE, BH thoſe remaining alive after a certain term of years; whence CE will anſwer the number of thoſe dead in that time: So AC, BD may repreſent the number

of

of the Elder Age ; *A F*,*B I* the Survivors after the ſame term ; and *C F*, *D I*, thoſe of that Age that are dead at that time. Then ſhall the whole Parallelogram *A B C D* be *Nn*, or the Product of the two Numbers of perſons, repreſenting ſuch a number of Perſons of the two Ages given ; and by what was ſaid before, after the Term propoſed the Rectangle *H D* ſhall be as the number of Perſons of the younger Age that ſurvive, and the Rectangle *A E* as the number of thoſe that die. So likewiſe the Rectangles *A I*, *F D* ſhall be as the Numbers, living and dead, of the other Age. Hence the Rectangle *H I* ſhall be as an equal number of both Ages ſurviving. The Rectangle *F E* being the Product of the deceaſed, or *Y y*, an equal number of both dead. The Rectangle *G D* or *R y*, a number living of the younger Age, and dead of the Elder : And the Rectangle *A G* or *r Y* a number living of the Elder Age, but dead of the younger. This being underſtood, it is obvious, that as the whole Rectangle *A D* or *N n* is to the *Gnomon* *F A B D E G* or *N n*— *Y y*, ſo is the whole number of Perſons or Chances, to the number of Chances that one of the two Perſons is living : And as *A D* or *N n* is to *F E* or *Y y*, ſo are all the Chances, to the Chances that both are dead ; whereby may be computed the value of the Reverſion after both Lives. And as *A D* to *G D* or *R y*, ſo the whole number of Chances, to the Chances that the younger is living and the other dead ; whereby may be caſt up what value ought to be paid for the Reverſion of one Life after another, as in the caſe of providing for Clergy-mens Widows and others by ſuch Reverſions. And as *A D* to *A G* or *r Y*, ſo are all the Chances, to thoſe that the Elder ſurvives the younger. I have been the more particular, and perhaps tedious, in this matter, becauſe it is the Key to the Caſe of Three Lives, which of it ſelf would not have been ſo eaſie to comprehend.

VII. If Three Lives are propoſed, to find the value of an Annuity during the continuance of any of thoſe three Lives. The Rule is, *As the Product of the continual multiplication of the Three Numbers, in the Table, anſwering to the Ages propoſed, is to the difference of that Product and of the Product of the Three Numbers of the deceaſed of thoſe Ages, in any given term of Years ; So is the preſent value of a Sum of Money to be paid certainly after ſo many Years, to the preſent value of the ſame*

ſame Sum to be paid, provided one of thoſe three Perſons be living at the Expiration of that term. Which proportion being yearly repeated, the Sum of all thoſe preſent values will be the value of an Annuity granted for three ſuch Lives. But to explain this, together with all the Caſes of Survivance in three Lives: Let N be the Number in the Table for the Younger Age, n for the Second, and v for the Elder Age; let Y be thoſe dead of the Younger Age in the term propoſed, y thoſe dead of the Second Age, and υ thoſe of the Elder Age; and let R be the Remainder of the younger Age, r that of the middle Age, and ϱ the Remainder of the Elder Age. Then ſhall $R+Y$ be equal to N, $r+y$ to n, and $\varrho+\upsilon$ to v, and the continual Product of the three Numbers Nnv ſhall be equal to the continual Product of $R+Y \times r+Y \times \varrho+\upsilon$, which being the whole number of Chances for three Lives is compounded of the eight Products following. (1) $Rr\varrho$, which is the number of Chances that all three of the Perſons are living. (2) $r\varrho Y$, which is the number of Chances that the two Elder Perſons are living, and the younger dead. (3) $R\varrho y$ the number of Chances that the middle Age is dead, and the younger and Elder living. (4) $Rr\upsilon$ being the Chances that the two younger are living, and the elder dead. (5) ϱYy the Chances that the two younger are dead, and the elder living. (6) $rY\upsilon$ the Chances that the younger and elder are dead, and the middle Age living. (7) $Ry\upsilon$, which are the Chances that the younger is living, and the two other dead. And Laſtly and Eightly, $Yy\upsilon$, which are the Chances that all three are dead. Which latter ſubſtracted from the whole number of Chances Nnv, leaves $Nnv-Yy\upsilon$ the Sum of all the other Seven Products; in all of which one or more of the three Perſons are ſurviving.

To make this yet more evident, I have added *Fig.* 8. wherein theſe Eight ſeveral Products are at one view exhibited. Let the rectangled Parallelepipedon $ABCDEFGH$ be conſtituted of the ſides AB, GH, *&c.* proportional to N the number of the younger Age; AC, BD, *&c.* proportional to n; and AG, CE, *&c.* proportional to the number of the Elder, or v. And the whole Parallelepipedon ſhall be as the Product Nnv, or our whole number of Chances. Let BP be as R, and AP as Y; let CL be as r, and Ln as y; and GN as ϱ, and NA as υ; and let the Plain $PRea$ be made parallel to the plain $ACGE$; the plain $NVbY$ parallel to $ABCD$; and the plain $LXTQ$ parallel to the plain $ABGH$. And our firſt Product $Rr\varrho$ ſhall be as the Solid $STWIFZeb$. The Second, or $r\varrho Y$ will be as the Solid $EYZeQSMI$. The Third, $R\varrho y$, as the Solid $RHOVWIST$. And the Fourth, Rrv, as the Solid $ZabDWXIK$. Fifthly, ϱYy, as the Solid $GQRSIMNO$. Sixthly, rYv, as $IKLMGYZA$. Seventhly. Ryv, as the Solid $IKPOBXVW$. And Laſtly, $AIKLMNOP$ will be as the Product of the 3 numbers of perſons dead, or Yyv. I ſhall not apply this in all the caſes thereof for brevity ſake; only to ſhew in one how all the reſt may be performed, let it be demanded what is the value of the Reverſion of the younger Life after the two elder propoſed. The proportion is as the whole number of Chances, or Nnv to the Product Ryv, ſo is the certain preſent value of the Sum payable after any term propoſed, to the value due to ſuch Chances as the younger perſon has to bury both the elder, by the term propoſed; which therefore he is to pay for. Here it is to be noted, that the firſt term of all theſe Proportions is the ſame throughout, *viz.* Nnv. The Second changing yearly according to the Decreaſe of R, r, ϱ, and Encreaſe of Y, y, v. And the third are ſucceſſively the preſent values of Money payable after one, two, three, *&c.* years, according to the rate of Intereſt agreed on. Theſe numbers, which are in all caſes of Annuities of neceſſary uſe, I have put into the following Table, they being the Decimal values of One Pound payable after the number of years in the Margent, at the rate of *6 per Cent.*

Years.	Preſent value of 1 *l.*	Years.	Preſent value of 1 *l.*	Years.	Preſent value of 1 *l.*
1	0,9434	19	0,3305	37	0,1158
2	0,8900	20	0,3118	38	0,1092
3	0,8396	21	0,2941	39	0,1031
4	0,7921	22	0,2775	40	0,0972
5	0,7473	23	0,2618	45	0,0726
6	0,7050	24	0,2470	50	0,0543
7	0,6650	25	0,2330	55	0,0406
8	0,6274	26	0,2198	60	0,0303
9	0,5919	27	0,2074	65	0,0227
10	0,5584	28	0,1956	70	0,0169
11	0,5268	29	0,1845	75	0,0126
12	0,4970	30	0,1741	80	0,0094
13	0,4688	31	0,1643	85	0,0071
14	0,4423	32	0,1550	90	0,0053
15	0,4173	33	0,1462	95	0,0039
16	0,3936	34	0,1379	100	0,0029
17	0,3714	35	0,1301		
18	0,3503	36	0,1227		

It were needleſs to advertiſe, that the great trouble of working ſo many Proportions will be very much alleviated by uſing Logarithms; and that inſtead of uſing $Nnv - Yyv$ for the Second Term of the Proportion in finding the value of Three Lives, it may ſuffice to uſe only Yyv, and then deducting the Fourth Term ſo found out of the Third, the Remainder ſhall be the preſent value ſought; or all theſe Fourth Terms being added together, and deducted out of the value of the certain Annuity for ſo many Years, will leave the value of the contingent Annuity upon the Chance of Mortality of all thoſe three Lives. For Example; Let there be Three Lives of 10, 30, and 40 years of Age propoſed, and the Proportions will be thus:

As 661 in 531 in 445 or 156190995, or Nnv
to 8 in 8 in 9, or 576, or Yyv for the firſt year, ſo 0, 9434. to 0,00000348
to 15 in 16 in 18, or 4320, for the ſecond year, ſo 0, 8900. to 0,00002462
to 21 in 24 in 28, or 14112 for the third year, ſo 0, 8396. to 0,00008128
to 27 in 32 in 38, for the fourth year, ſo 0, 7921. to 0,00016650
to 33 in 41 in 48, for the fifth year, ſo 0, 7473. to 0,00031071
to 39 in 50 in 58, for the ſixth year, ſo 0, 7050 to 0,00051051

And ſo forth to the 60th year, when we ſuppoſe the elder Life of Forty certainly to be expired; from whence till Seventy we muſt compute for the Firſt and Second only, and from thence to Ninety for the ſingle youngeſt Life. Then the Sum Total of all theſe Fourth Proportiona's being taken out of the value of a certain Annuity for 90 Years, being 16,58 years Purchaſe, ſhall leave the juſt value to be paid for an Annuity during the whole term of the Lives of three Perſons of the Ages propoſed. And note, that it will not be neceſſary to compute for every year ſingly, but that in moſt caſes every 4th or 5th year may ſuffice, interpoling for the intermediate years *ſecundum artem.*

It may be objected, that the different *Salubrity* of places does hinder this Propoſal from being *univerſal*; nor can it be denied. But by the number that die, being 1174. *per Annum* in 34000, it does appear that about a 30th part die yearly, as Sir *William Petty* has computed for *London*; and the number that die in Infancy, is a good Argument that the Air is but indifferently ſalubrious. So that by what I can learn, there cannot perhaps be one better place propoſed for a Standard. At leaſt 'tis deſired that in imitation hereof the Curious in other Cities would attempt ſomething of the ſame nature, than which nothing perhaps can be more uſeful.

The

The WISDOM *of* GOD *manifeſted in the Works of the Creation; in Two Parts. By* John Ray, *Fellow of the* Royal Society. *The Second Edition very much enlarged.* London, *Printed for* Samuel Smith: *in* 8°. 1692.

THE Deſign of our Author in this Treatiſe, is manifeſt by the Title it ſelf, which he endeavours to make good from ſeveral Heads, as firſt, from the *Multitude* of the *Creatures*, cœleſtial and terreſtrial, and from the poſſibility, that the fixt Stars may be ſo many Suns, attended with the like Train as we find our Center, the Ruler of our Motions, is accompanied with. Hence he proceeds to gueſs at the number of *Terreſtrial* Bodies, animate and inanimate: Of *Beaſts* known and deſcribed about 150; of *Birds* about 500; and of *Fiſhes* the like number; *Inſects* are more numerous; of *Butterflies* and *Beetles* 300; and if *Caterpillars* are reckon'd as a diſtinct Species, that number is doubled, and the *Fly-kind* at leaſt equals both the other: *Creeping Inſects* very numerous. In ſhort, if as he conjectures the Britiſh Inſects amount to 2000, the total ſum of thoſe of the whole Earth may be 20000, if they hold the ſame proportion as the Britiſh and Foreign Plants do. Of *Plants*, he thinks, there are not fewer in the World than 18000: And laſtly, of *Foſſiles*, *Stones*, and the like, he gives no gueſs at their number, but concludes it very great.

Next he proceeds to cenſure the *Ariſtotelian*, *Epicurean*, and *Carteſian Hypotheſes*, as uncapable of explaining the *Phœnomena* of Nature; and for the formation of the Bodies of Animals, he has recourſe to the *Senſitive Soul*, if it be immaterial; but if material, to a *Plaſtick Nature*. And here he treats in ſhort of the Souls of *Brutes*. At the 48th Page he ſeems to encline to the *Atomical Hypotheſis*, as to the ranging inanimate Bodies, and explaining ſome of their Operations. Our Author then enters into a more particular Account of ſome of the Creatures as the Sun, Moon, *&c.* and holds the *gravitating* Principle to be the Band that keeps the Univerſe in order, though he attempts not to explain what it is, or how cauſed. He proceeds to the Uſes of the four Elements, as *Fire*, *Air*, *Water*, and *Earth*, hinting at the life of the *Fœtus in utero*, *pag* 65. and from the motion of the Water gives the reaſon why moſt Water-Plants grow flat, their edges more eaſily cutting the Stream, than if they were round. He then touches upon the *Meteors*, as Rain, Wind, *&c.* and next of inanimate Bodies; where, as to formed Stones he determines not the buſineſs of *Petrification*, enlarging upon the uſe of the *Loadſtone*. He proceeds to *Metals*.

As to *Plants*, he refers their Conſtancy in continuing their Species to a *Plaſtick* Nature, as well as their Stature, Figure, and the like, and ends with the uſes of the ſeveral parts thereof.

Treating of *Animals*, he thinks it probable, that the *Females* as well of Beaſts as Birds, have in them, from their firſt formation, the Seeds of all the young they ſhall ever produce; and ſets it down as a manifeſt Argument of Divine Providence, that Birds are not vivaparous, ſo as that they have no hindrance in their flying and way of living: Obſerving further the ſtrange Memory and Order Birds have in feeding their Young, not omitting or forgetting one, but feeding them all gradually; with ſeveral other curious Remarks of the building of their Neſts, Brooding, &c. and by the way treating of the Juice afforded by the *Glands* of the *Stomach*, he hints at the notable Vertue of the inſipid *Saliva*, in its killing Quickſilver, fermenting Dough, taking away Warts, &c. He admires the Curioſity and Contrivance of the *Honeycomb*, and particularly the *Tree-Bee*, which Inſect he deſcribes, with the manner of its generation. He proceeds to *Quadrupedes*, and concludes this Head with the fitneſs of the Parts of ſeveral Animals, for their particular Natures and ways of living, *viz.* in the *Mole*, *Antbear*, *Chamælion*, *Woodpecker*, and *Swallow*; obſerving that the reaſon why *Swallows* fly low before Rain may be from the *Inſects*, which they prey upon, which being ſenſible of the Vapors of the ſuperiour Regions of the Air, deſcend nearer to the Earth at ſuch times. Next, that the Parts of *Birds* are all fitted for flying, as thoſe of *Fiſh* are for ſwimming; obſerving, that though no Land-Fowl have ſhort Necks and long Legs, yet the contrary is ſeen in many whole-footed Water-fowl, Nature providing them with a long Neck, that they may fiſh therewith at the bottom of the Water.

Next our Author anſwers an Objection too long to be here inſerted; and having touch'd upon ſome other Heads, as the Diſcoveries made by Dr. *Hooke*, and Mr. *Lewenhoek*, by the *Microſcope*, in minute Animals and their parts, he proceeds to ſome Practical Inferences, and having ſelected two particular Pieces to inſiſt more largely upon, *viz.* The whole Body of the *Earth*; as to which, he remarks its Spherical Figure fitted for Motion and Strength, and ſhews its diurnal and annual motions no way diſſonant to the Scriptures. Coming to the outward face thereof, he inſtances in the admirable uſe of ſome Plants, and concludes this firſt Part with the neceſſity of *Mountains*, for the production of Springs and Minerals, the Conveniencies for Habitation, delightful Proſpects, production of variety of Plants, entertainment and maintenance of ſeveral Beaſts, Birds, and Inſects, with the hindering the evagation of Vapours to the North and South, from the hot Countries, where they are moſt needful.

In the *Second Part* of this Work our Author proſecutes the ſame ſubject from the conſideration of *Man*, and that from eight general Obſervations, 1ſt, Of his *Erect Poſture*, which he ſhews to be natural from the length of the Legs, and ſtrength of their Muſcles, poſition of the Face, &c. 2dly, In that nothing is *wanting*, or *redundant*. 3dly, The *Parts* are moſt conveniently placed for uſe and ornament. 4ly, The *Proviſion* made for the Security of the Principals, as the Heart, Brain, and Lungs. 5ly, The moſt *uſeful parts* being provided againſt Accidents, by their being in pairs; and the many *Conveniencies* they have to get rid of what offends them. 6ly, The

Conſtancy obſerved in the principal parts, which cannot proceed from Chance, whereas there is a great variety in the leſs neceſſary, as in the Ramifications of the Veins, Arteries, and Nerves, wherein Nature ſeems to ſport her ſelf. *7ly*, *Pleaſure* annext to thoſe actions that ſupport the *individuum*, as Eating, Drinking, and thoſe that continue the Species. *8ly*, The *Multitude* of *Intentions* to be regarded in the forming of our Bodies for the various motions and operations thereof. Coming to particulars, he obſerves the great *Variety* in the *Faces* of Men, and the *Capacity* of the Head from its Spherical Figure, to contain a large Brain: In the next place he enlarges on the *Eye*, and its ſeveral parts endeavouring at a reaſon why Objects ſeem not inverted, though they are ſo painted on the *Retina*, which ſeems to need a farther Explication. He obſerves from *Nuck*'s Experiment on a Dogs-Eye, that the Aqueous Humor is repairable, as being moſt ſubject to Caſualties. As to the *Ear*, he obſerves, that if the external Ear (which by degrees contracts and draws the ſound inwards) be cut off, the Hearing has been much impaired, if not quite ſpoiled; and takes notice of the alteration of its Figure from the diſtance of the Sound he refers for a more particular Explication of this part, and its uſe to Monſieur *Du Verney*'s Treatiſe of the Ear. Next as to the *Teeth*, having recapitulated Mr. *Boyl*'s Seven Obſervations of them, he adds, That the *Molares* are placed neareſt to the Center of Motion, where there is the greater ſtrength required. And laſtly, The motion of the *Jaws* is tranſverſe, as moſt proper for chewing. Treating of the *Tongue*, he notes with *Des Cartes*, that Brutes have no cogitation ſince none of them can be brought to ſignifie their Conceptions by artificial Signs, either Words or Geſtures, the Signs which they uſe being motions of ſome of the Paſſions. Having touched at the uſe of the *Saliva*, for digeſtion of the Food, he obſerves the *Annular Formation* of the *Windpipe*, whoſe Rings are not entire, leſt it ſhould preſs too hard upon the Gullet. Treating of the *Heart*, he allows it not to be conſervatory of the vital Flame; the Lungs ſerving rather for the accenſion and maintaining of that Flame, but ſhews its admirable contrivance from its Muſcles, Valves, and the like, to be a proper *Machine* to continue the *circulation* of the Blood, aſſiſted much by the quadruple Coat of the Arteries, eſpecially its third or muſculous one, firſt diſcovered by Dr. *Willis*, effecting a Conſtriction, or kind of *Periſtaltick* Motion. Having treated of the Structure and Uſes of the *Hand*, and of the *Vertebræ* of the Back-bone, he obſerves the Proviſion that is made for the more eaſie *motion* of all the *Joynts*, and prevention of heating and fretting, by an oily and a mucilaginous Juice. There are ſeveral other Remarks on the *Thorax*, *Belly*, *Bladder*, *Liver*, *Kidneys*, and the like, which I omit; and coming to the *Bones* and *Muſcles*, he affirms, that there ſeems to be therein more *Geometry* than in all the artificial Engines in the World. Which he leaves to the *Mathematicians* to handle, as has been attempted by *Borelli* and others.

Our Author waves the conſideration of the *Formation* of the *Fœtus*, and ſuppoſes Impregnation to proceed from ſome *contagious Vapour*, or *ſubtile Effluvium* of the Male Seed. Which he believes have a great ſtroke in generation, in that the Mule and other Creatures moſt reſemble the Male Parent. Taking occaſion here to ſpeak of *ſpontaneous Generation*, he affirms, that there is no ſuch thing in Nature; but that all, nay, the moſt contemptible *Inſect*, is generated by the Animal Parents of the ſame *Species*. The ſame he confirms as to *Plants*, by an Experiment of *Malpigius*, who covered Earth taken from a deep place with Silk many times doubled, which though it admitted the Air and Water, yet produced not any Plant; and concludes, that a *ſpontaneous Generation* of Animals and Plants will be found, upon due examination, to be nothing leſs than a *Creation* of them. He enforces this Opinion by the Suffrages of the moſt Experienc'd in this matter, as *Swammerdam*, *Malpighi*, *Liſter*, *&c.* For this he brings ſeveral Arguments, and anſwers the moſt material Objections, and as for the *raining* of *Frogs* and other *Inſects*, he believes it with the ſame Faith, as that *Spaniſh Gennets* are begotten by the Winds, ſince each Story is atteſted, as he ſays, by good Authors, and he that can ſwallow this, hath, he thinks, made a fair ſtep towards believing it may rain Calves too, ſince it is reported that one fell out of the Clouds in *Avicenna*'s time. Here he takes notice of the long *Venereal Embrace* of the *Frogs*, for at leaſt a whole month indeſinently. As to *Inſects* produced in Animal Bodies, he concludes them not *ſpontaneous*, from their exact agreement, and perpetual ſimilitude, in the ſhape and figure of their Bodies, and concludes, that the Eggs which produce them are taken in with the Food of the Animal in which they are found.

In the next place he gives ſeveral *Miſcellaneous* Obſervations of the Structure, Actions, and Uſes of ſome Parts of Animals, omitted in the precedent Diſcourſes; as, That God effects the ſame thing by different means inſtanced in the Varieties of Digeſtions in the Stomachs of ſeveral Animals, and the like. By the way he ſays, that *Swine* wallow in the Mire, and *Poultry* bask themſelves in the Duſt, not to cool themſelves, but to deſtroy and choak the *Lice* and other importunate Inſects. Our Author has other Obſervables touching *Reſpiration*, the *Foramen Ovale* in amphibious Animals, the *Epiglottis*, which part the Elephant has not, neither needs it, there being no Communication betwixt his Lungs and Oeſophagus. Some Inſtances of the Sagacity of the *Tortoiſe*; of theirs and the *Armadillo*'s Armour, which latter contracts it ſelf into a rouud Ball, by the means of a notable Muſcle on each ſide, conſiſting of many *Fibres*, decuſſating each other like the letter X. Next he hints at the Uſes of the *Fat* and the nictating Membrane in the Eyes of Beaſts, and Birds, tranſcribing a large account of this part out of the *Pariſian* Anatomy of Animals. Next of the ſudden growth of *Fleſh-Flyes*, which he finds neceſſary for their production; with ſome Particularities touching other Animals. He conjectures, that *Cartilagineous Fiſh* raiſe and ſink themſelves to any Depth, by the Water which they take in and let out again at pleaſure, by the help of Muſcles for that purpoſe, at two holes in the lower part of their Belly.

Speaking of *Plants*, he ſays, it is the deſcending Juice which is taken in by the Leaves that nouriſhes both the Fruit and Plant. There are ſeveral other particulars worth the Reader's peruſal, and after all he concludes with many practical Inferences and Deductions from the whole.

The whole Treatiſe, though it be of a Philoſophical Nature, ſeems to be of great uſe for ſuch as make popular Diſcourſes; and as it is not far above the Capacity of the *Meaner*, ſo there are ſeveral Paſſages that will at leaſt give hints and aſſiſtance to the greateſt *Theologues*.

Three Phyſico-Theological *Diſcourſes, concerning,* 1. *The Primitive* Chaos, *and Creation of the World.* 2. *The General Deluge, its Cauſes and Effects.* 3. *The Diſſolution of the World. By* John Ray, *S. R. S. The Second Edition.* Lond. *printed for* Samuel Smith, 8o. 1693.

IN the firſt Diſcourſe concerning the *Chaos*, (the Notion whereof our Author aſſerts in his Preface to be divinely revealed) he produces the Teſtimonies of ſeveral Heathen Writers, to prove the production of all things out of it, (which they looked upon ſelf-exiſtent, and unproduced, as he thinks, erroneouſly) which Opinion he ſhews conſentaneous to *Moſes*, there being a gradual formation of things related, which were all produced, as he ſuppoſes, out of præ-exiſting Seeds, which he ſays were firſt created by God. As to the ſeparation of the *Land* and *Water*, which at firſt covered the face of the Earth: He propoſes, that it might be effected by the ſame Cauſes which raiſe Mountains now, *viz. Subterraneous Fires* and *Flatus*'s, ſuch as *Ovid* in the 15th Metamorph. deſcribes near the City *Trœzen*; and a later Inſtance near *Puzzuolo*, of a new Mountain; which laſt he deſcribes from his own obſervation. He mentions ſeveral other Hills raiſed, and now oft-ſhaken by Earthquakes and Subterraneous Fires as the *Andes*, *Alps*, *&c.* Taking notice of an extraordinary one, which in the time of *Valentinian* ſhook the whole World, with ſome Paſſages out of *Strabo* and others, he ſhews from a Paſſage out of *Julius Ethnicus*, and Father *Kircher*, that there may be a Communication from one burning Mountain to another, though at a great diſtance, by Vaults under the Sea; the bottom whereof, except where it is Rocky, he by the way aſſerts to be very even. Of *Submarine* Plants he obſerves, there are none at great depths for want of Air. This depth uſually anſwers the heighth of the adjoyning Hills and Land. He treats of the uſe and neceſſity of Mountains. Coming in the next place to the *Creation* of *Animals*, he propoſes ſome Queſtions, as, Whether *God* made at firſt the Seeds only of all Animals, and ſcatter'd them over the Earth, or made the firſt ſett of *Animals* in perfection, giving each *Species* a power to generate? then, Whether he made a great many of a ſort, or only two, a Male and a Female? And from theſe another Queſtion ariſes, Whether the *Ovaries* of the firſt Animals, actually included in them the whole number, to be produced by that *Species* to the end of the World? Which he enclines to, and ſeems to make the Female the chief Agent in Generation; each Egg containing an *Animalcule*, the Arguments for and againſt this *Hypotheſis* make up the Remainder of this Diſcourſe: Though he confeſſes himſelf not fully ſatisfied, as to all Doubts that may be raiſed, but ends with his Reaſons for diſſenting from *Lewenhoek*, that all Animals proceed from an *Animalcule* in the Male *ſperme*.

The *Author* takes the ſame method in the *Second Diſcourſe* of the *General Deluge*, bringing firſt the Teſtimonies of the ancient Heathen Writers concerning it, endeavouring to ſhew, that by *Deucalions* they underſtood *Noah's* Flood, which they alſo make univerſal, though he owns there was in *Theſſaly* ſuch a particular Flood as they call *Deucalion's*, about 700 years after *Noah's*, and that of *Ogyges* in *Attica*, about 230 years before *Deucalions*. Proceeding to treat of the Cauſes of this general Flood, rejecting that of the Airs being turned into Water, alledged by *Kircher* in *Arca Noæ*, he pitches upon thoſe two mentioned in *Geneſis*, the breaking up the Fountains of the great deep, and opening the Windows of Heaven, by the laſt of which he ſuppoſes a great quantity of Water may be afforded, taking the Waters above the *Firmament* to be Waters lodged above the inferiour Regions of the Air. By the Fountains of the Deep, he underſtands the ſubterraneous Waters. As to the Expence of the Sea-water by Vapour, he concludes the Receipts of the *Mediterranean* to fall ſhort of its expence. He queſtions whether there be any under-Currents in the Sea, and proceeding to his preſent Subject of the breaking up the Fountains, he by the way diſſents from Dr. *Plot*, in his Nat. Hiſt. of *Staffordſhire*, *That the Valleys are as much below the Surface of the Sea as the Mountains are above it*, ſince the Rivers run down from thoſe Valleys into the Sea; and ſeems diſſatisfied with the Opinion of an inferiour circulation of Water, as not ſufficiently demonſtrated how it can be performed. Having obſerved that the Hills and Dry Land is ſo equally diſperſed over the World, as to counterbalance each other, ſo that the *Centers* of Motion, Gravity, and Magnitude concur in one, he diſcourſes occaſionally of the original of *Springs*, all which he holds to be partly from Vapors condenſed into Dews, and partly from Rain and Snow; giving his Thoughts upon Mr. *Halley's* late *Hypotheſis*; coming at laſt to what he thinks the moſt probable Cauſes of the Flood, *viz.* The *Changing the Center* of the Earth at that time, and ſetting it nearer the middle of our Continent, whereupon the *Atlantick* and *Pacifick* Oceans preſſing upon the *ſubterraneous Abyſs*, by that means forced the Water upwards and compel'd it to run out at the wide mouths made at the breaking up of the Fountains of the Deep. Theſe Waters thus poured out upon the Earth, the declivity being changed by the *Removal* of the *Center*, could not flow to the Sea again, but ſtagnate upon the Earth; and after the Earth returning to its old *Center*, theſe Waters return'd alſo to their former Receptacles. He adds another *Hypotheſis*, That the Divine Power might at that time ſo depreſs the Surface of the *Ocean*, as to force the Waters of the *Abyſs* through the fore-mentioned Channels, *&c.* An *Hypotheſis* like the former of theſe you will at the end of a Treatiſe, *de Potentia Reſtitutiva*, or of Springs publiſh'd by Dr. *Hooke*, *anno* 1678. *pag.* 50. *Where, by the removal of the Center toward the* Antipodes, *he explains the appearance of ſeveral Iſlands in our Seas, by the Receſs of the Water; which formerly were not obſerved*, &c. In the next place our Author ſpeaking of the *Effects of the Deluge*, has a particular Chapter of *formed Stones*, *Sea-ſhells*, and the like Bodies found at diſtances from the ſhore, and brings the Arguments at large on both ſides, for and againſt their being originally *Shells*, *Bones*, *&c.* to which being long, we refer: In which he owns himſelf not to be yet ſatisfied on either ſide: He adds the draughts of ſome of the moſt different kinds of theſe Bodies, and leaving the matter undetermin'd, determin'd, proceeds to give ſome account of the Changes that have happened to the Earth ſince the general Deluge, as, the breaking off of ſome *Iſlands* formerly joyned to the *Continent*, ſome Places gained from the Sea, others cover'd by it. Other Changes happening to the Earth, by the ſinking of *Mountains*, Changes by *Earthquakes*, where he touches upon that lately happening in *Jamaica*, and that in *England* in *Sept.* laſt, of which he obſerves the conſiderable Circumſtances out of a Letter from Dr. *Robinſon*, and as to *Earthquakes* in *England*, that they have been very ſhort, and finiſht at one Exploſion, an Argument that the Cavities wherein the enflamed matter is contained are here very narrow. Other Changes have been cauſed in the Earth by *extraordinary Floods*, from long and continual Rains, others by boiſterous *Winds*, and the like, which with ſome Remarks, that the Earth does not proceed ſo faſt towards the levelling and general Inundation, as the force of theſe Cauſes ſeem to require: Concludes this ſecond Diſcourſe.

The Third Diſcourſe being more *Theological*, and leſs related to the deſign of theſe *Tracts*, I ſhall be the more brief in the account thereof, and waving the beginning thereof, ſhall only obſerve, that our Author, in order to prove his Aſſertion of a general *Diſſolution by Fire*, beſides Scripture-proofs, and the Opinions of the *Primitive Fathers*, brings ſeveral from the *ancient Philoſophers*, whoſe Opinions were, that the Diſſolution of the World ſhould be by Water and Fire, alternately at certain Periods; the Gods themſelves not being free from theſe *Cataſtrophes*. Coming in the next place to the Queſtion, Whether there be any thing in *Nature* that may probably cauſe or argue a *future Diſſolution?* He grants to the *Peripateticks*, that ſuppoſing the ordinary Concourſe of *God* with Second Cauſes, the World might endure for ever, there being no ſuch Decay in Nature as might argue the contrary. Proceeding to Particulars, he examines the four probable Cauſes of ſuch a Diſſolution; firſt, as to the poſſibility of the *Water*, in proceſs of time, overflowing the *Earth*; from the Steeple of *Craich*, in the *Peak* of *Derbyſhire*, (formerly not to be ſeen at a certain diſtance, but now viſible, by the ſinking of an interpoſed Hill, which the Rains have gradually leſſened and waſh'd down; with ſome other Obſervations of the like Nature) he argues, that the Waters may at laſt level the whole Earth, and bring a total *Subverſion* thereof; to which purpoſe is inſerted a large Quotation out of *Joſephus Blancanus*. For a ſecond cauſe he alledges the *Extinction of the Sun*, inſtancing in ſome Obſervations of unuſual defects and paleneſs of the *Sun* for a conſiderable time, and thinks it not impoſſible but the *Maculæ Solares* may ſo far prevail, as wholly to rob us of his neceſſary Influence. For a third Cauſe he brings the *Eruption* of the *Central Fire*, the poſſibility whereof he argues, particularly from *new Stars* appearing and diſappearing, which *Phenomenon* he thinks may be ſo ſolved. A fourth Cauſe may be the *dryneſs* and *inflammability* of the Earth in the *Torrid Zone*, where by the way he explains what *Fire* is, and in the end rejects this Cauſe as inſufficient. Coming to that Queſtion, How this Diſſolution will be effected; he anſwers, By *Fire*, and concludes it will be after a miraculous way, ſuddenly, *&c.* He determines not the Time, but allows it poſſibly at a great diſtance, and thinks it likely, that it will be a *Renovation*, and not an utter *Annihilation*, which he proves from ſeveral old Writers. And ſo much for the Philoſophical part of this *Treatiſe*.

Leonardi Plukenetii *PHYTOGRAPHIA ſeu Plantæ quamplurimæ novæ & Literis huc uſque incognitæ ex variis & remotiſſimis* Provinciis *ipſiſq;* Indiis *allatæ* Nomine & Iconibus. *TABVLIS ÆNEIS* 130 *Fig. ferè* 800 *magnâ cum Induſtriâ & inſigni ſanè in ſucceſſores beneficio Illuſtratæ. Fol. Londini,* 1692. *PARS III.*

THE Curious in *Botany* muſt needs own themſelves highly obliged, as well to the Induſtry as Sincerity of the moſt Ingenious Author, ſince what he formerly promis'd touching this Subject he now amply performs in this *Third Part*, enriching the World with a new Set of *Phytographick Tables*, which he humbly dedicates to His preſent *Majeſty*, wherein he exhibits to publick view the Figures and Deſcriptive Titles of near 800 Plants, all different from what he publiſhed the foregoing year, and the greateſt part of them hitherto either not deſcrib'd, or not figur'd.

In this Work the judicious Reader may obſerve, that as there are really New and Non-deſcrib'd *Species*, that will afford Entertainment and Diverſion to the profounder Enquirers, and ſuch as are in the upper Form of *Botany*; ſo there are others would be thought as ſuch, to the unnatural encreaſe of the Faculty, whereby the Superficiary Proficients would for ever be deterr'd from attempting to graſp at ſuch an Immenſity, did not the ſtudied Care of our elaborate Author, in his ſtated References and Synonymes, contract their Number, and reduce the Account of *Botany* to its juſt and natural Limits. A ſingle Inſtance hereof (among many others) you have in the *Vvifera litorea, &c.* from *America*, or the Sea-ſide Grape, by thoſe of *Barbados*, in *Tab.* 236. which although by many eſteem'd as a new Plant, is really no other than the *Raiſinier* of Monſ. *Rochfort*, or *Ouliem* of the Charibbeans *Hiſtoire des Antilles*. The ſame with *Obe* of the Dutch *Prodromus*, and the *Sideroxylum folio ſubrotundo* ejus'd. The *Arbor Inſulæ Tabago materiæ ligno Braſiliano ſimili, de Laet.* The *Papyracea arbor, Guajabara Barbaris. Hiſpanis Vvero. Jo. Baub. Copey in Inſulâ Hiſpaniolâ. Caſp. Baub. Pinac.* and *populus rotundifolia Americana*, *Parkinſon*; as any may perceive by the Synonymous Titles, ſubjoyn'd to the forementioned Table. So that here are no leſs than eight ſeemingly ſeveral and diſtinct Plants, united into one and the ſame thing; and were this Method duly obſerv'd in the whole courſe of *Phytology*, the Hiſtory of Vegetables would not appear ſo bulky and unbounded, but any ingenious perſon might in ſome reaſonable time take a full view of all its Heights and Depths, and utmoſt Extent, without the danger of Dizzineſs or Affrightment.

In theſe moſt excellent *Tables* you will find the Hallucinations and Miſtakes of ſeveral Authors rectified, their Obſcurities cleared up, and many other uſeful Illuſtrations, which I ſhall forbear to enumerate in this place; only of ſome of their particular Rarities we ſhall give the Reader a *Specimen*.

Beſides the *Mexican Abies*, and that elegant Southernwood from *Portugal*, there is a whole Set of curious *Acacia*'s, moſt of them Thorny, yet ſome without Thorns, from *Java*, *Maderaſpatan*, *Ceylon*, *Africa* and the *Weſt-Indies*. The *Acacia Africana ſpinis candicantibus horrida, &c.* in Tab. 123. is the true *Ægyptian Acacia* that the incomparable Botaniſt *Fabius Columna* raiſed of Seed at *Naples*, a Figure whereof he has given us with his learned Notes upon *Reccus*, pag. 866.

The *Acacia Abrua foliis*, &c. of the ſame *Table*, our Author thinks may be the ſame with the *Frutex Palæſtinus* of *Bellonius*, which was ſuppoſed by him to be the Tree produciug Myrrhe. *Obſ. lib.* 2. *cap.* 8.

An *Acer foliis trifidis & quinquifidis Virginianum*, which by the Author is ſuppoſed to be the *Arbor Saccharifera Canadenſium Indorum apud Cl. Rajum*. Hiſt. Pl. 1701. A pretty Myrtifoliate *Alnus* in the *Appendix* from *Bermudos*, in uſe among the Tanners. Several ſorts of Maiden-Hair from *Narbon*, *Africa*, *Braſil*, *Barbados*, *Bermudos*, and ſome other Iſlands of the *Charibbees*. Four ſtately kinds of *Aloes* from the *Cape*. Various ſorts of *Amaranthoides* from *Maderaſpatan*, one with ſharp Prickles along the Stalk, and a Thorny ſort of *Alkanet* from the ſame place. There are no leſs than ſix ſorts of *Anona*, with a critical diſtinction of them each from other. The *Benjamin-Tree*, with its Branch and Flowers, from the Continent of *Virginia*. The *Cubeb-Tree*, or ſuppoſed to be ſo from *Fort St. George*, as alſo from *Bengal*. A *Balſam-Tree*, from *Barbados*, call'd by the Planters *Spaniſh Aſh*. As alſo a *Spaniſh-Oak*, from the ſame Iſland. A ſiliquiferous Tree, with the Leaves of Beech.

The Tree called *Mancinello*, being remarkable for its venomous Qualities, together with its Fruit: From this Tree a Juice is drawn ſo venemous, that you cannot touch it, but the Skin riſes with great Pain, and becomes as black as though a hot Iron were applied to it. The *Arbor Stacteflua putata*, or a Tree that drops *liquid* Myrrhe, from *America*. The *Poyſon-Wyth* of *Barbados*, which is a kind of *Bryony*. Three diſtinct kinds of the *Tree Pimiento's*, from the Iſlands of *Jamaica* and the *Barbados*. The Flowring *Beech* of *Virginia*, and the Silver *Cheſtnut*, which differs from the *Chinquapin* of the ſame place, and may be the *Leucoma* of Authors.

A new Family of the *Cenchramidea*'s, from *Barbados*; the Fruit of one of theſe may well be ſuſpected that of the *Bdellium* in *Lobel*'s *Icons*, call'd Balſam-Apple by our Planters in *Barbados*. A *Cedar* of the ſame Iſland with the Leaves of an *Aſh*. Sundry ſorts of Cherries from *America*, *Arabia*, and the *Cape*. A wonderful *Cereus*, that creeps upon the Gronnd like a Serpent, from *America*. An elegant ſort of *Chriſtophoriana*, with the Leaves of *Malabathrum*, called *Nettle-Tree* by thoſe of *Barbados*. *Chryſanthema*, various kinds, both *American*, *Eaſt-Indian*, *African*, and *Perſian*. A wild *Cinamon* of *Barbados*, with unvein'd Leaves. Two wonderful *Ciſtus*'s, from *Virginia*, and one from *Ceylon*. Several ſtrange *Celutea*'s, from the *Eaſt-Indies*, *Java*, *Maderaſpatan*, *Ægypt*, and *Veracruce* in *America*. As many *Convolvuli*, from *America*, *Jamaica*, *Virginia*, the *Cape of Good-Hope*, *Ceylon*, and Maderaſpatan.

The *Cordis Indi folio & facie fruteſcens Portoricenſis Paradiſ. Batav. Prod.* whereunto belongs the *Quaubmecatl* or *Zarzaparilla*, 2, & 3. *Nov. Hiſpan. Terent.* apud *Rece.* p. 289. as our Author has reaſon to ſuſpect. That other *Cordis Indi folio & facie*, *&c.* from *Curaſſao*; to which he refers the *Aquitztli* of *New Spain*, *apud Rece.* p. 354. an elegant Tree called *Coralwood*. Strange *Cucumbers* from Malabar, Maderaſpatan, and from *America*. Several Calibaſh-Trees from the *Eaſt-Indies* and *America*. A Berry bearing *Doddar*, from the Iſland of *Barbados*, perhaps the ſame with *Acatsjavalli Hort.* Malabar, par. 7. And *Pearl-Tree* of *Surinam*, which is a kind of *Euonymus*.

The true *Ficus Indice arcuata*, and the Bearded *Fig-Tree*, from *Barbados*, both of the *Arbor de Raiz* kind, propagating themſelves by ſtringy Fibres emitted from their Branches, which touching the ground, take Root, and produce new Trees. Several ſorts of *Ferns*, ſome Natives of *England*, but never till now figur'd; three from *Africa*, two from *Virginia*, and one from the Academick Garden of *Padua*, as alſo in the *Appendix*; four more from the Iſland of *Bermudos*.

The *Manna Tree* or *Aſh* of *Aleppo*, ſeveral moſt noble kinds of *Geniſta*'s from the *Cape*, and *Maderaſpatan*; ſome with Spines, others without. Six of the *Goſſipium* kind, both from the *Eaſt* and the *Weſt-Indies*. A multitude of exotick *Graſſes* from moſt parts of the habitable World. A ſtrange *Ilex* from *Virginia*, with tuberoſe Roots: And others of the ſame Family from *Maderaſpatan*.

Several *Laſerpitiums*, with a critical diſtinction of each kind. Two ſorts of *Silver Trees*, growing upon *Mount Atlas*; the firſt is ſaid to be Pomiferous, the other is an *Epiphyllanthos*, both ſeem the Miracles of Nature. The *Silver-wood* or White-wood, called by our Author *Leucoxylum*, is by him ſuppoſed the ſame with the *white Braſil, or Lignum Braſilianum, ut charta candidum Jonſt.* Dendrol. 454. *Linſcholen* tells us, 'tis whiter than either Chalk or Snow, *Ind. Or. P.* 3. *cap.* 6. It is a Quinquefoliate and Siliquiferous Tree, with winged Seed. The *Lignum Rhodium* Tree, called by the Planters of *Barbados* Lightwood, and *Lucinium* by our Author.

The various ſorts of *Lycia*, from *Porterico*, *Candy*, and *Maderaſpatan*. The *Lyſimacha non papposa*, ſeveral kinds thereof from both the *Indies*. The *Mammee-Tree* of the *Weſt-Indies*, which our Author ſuſpects to be the *Arbor*, *Vinifera*, *Couton*, *Juglandis*, *Similis* of *John Bauhine*, and the *Momin* of Mr. *Ogilbey*, which, as he relates, grows to the bigneſs of an Apple-Tree, the Fruit which it bears reſembles a green Cucumber, of a pleaſant Juice, the Skin always green and prickly, the Seed about the bigneſs of a French Bean, generally black, and ſtreaked with golden-colour'd Veins.

Two ſorts of the *Mangle-Tree*, of the *Arbor de Raiz* kind, though no Figg; the firſt is the *Paretuveir* of Monſieur *Rochfort*, the ſame with the Oyſter-bearing Tree, that grows in *Sierra Liona* of *Purchas Navigat* Tom. 1. the true *Arbor de Raiz* of *Linſchoten*, P. 4. *Ind. Or.* and one of the *Kandels* of *Hort. Malab.* The *Manihot Indorum*, or *Mandioca*, whereof the Indians make their Bread *Caſſadar*.

The *Angelina* of *Piſo*, and Blackwood of thoſe of *Barbados*.

A ſtrange ſort of a Milky *Oleander*, with a yellow Flower, the *Eſnotli*, *Nov. Hiſpan. Tereut. apud Reccum.* p. 443. A *Nymphæa* from *Maderaſpatan*, with a Leaf like the larger Indian Creſſe, but much ſtiffer, which our Author conceives to be a ſort of the true *Colocaſia* or *Ægyptian* Bean of *Dioſcorides* and *Theophraſtus*, whoſe Root was called *Colocaſia*.

Several ſtrange Nuts from *America* and *Ceylon*, and one kind intercommon to the Iſlands both of *Barbados* and *Ceylon*: As alſo another in the *Appendix*, that came from *Veracruce*. Two ſorts of moſt fragrant *Baſil*'s from *Maderaſpatan*. Various *Paſſifloræ*, from *Curaſſau*, *Braſil*, and other Parts of *America*. *Pentaphylloides* from *Sweden*, *Scotland*, and *Ireland*: A pretty Myrtifoliate *Periclimenum*, from *Maderaſpatan*; and another from the ſame place. Another ſtrange kind from *Zeylon*; a fourth from *America*, and a fifth Variegate in its Leaves from the Royal Garden at *Paris*. Great variety of *Phaſeoli* from *Africa* and both the *Indies*; a long *Pepper* from *Braſil*; and ſeveral *Purſlanes* both with and without Thorns, from the Summer Iſlands of *America*. Plumbs in abundance from *Barbados*, *Virginia*, *Malabar*, and *Maderaſpatan*. Two ſorts of *Sebeſten*'s, the true *Elemnifera*, which is a Plumm-Tree, and that *Nucipruniferous*, which in *Barbados* they call the *Maſtick-Tree*. The *Sope-Berry*, which is properly a Plumm, or between Nut and Plumm, *Indian Damozen*, and the *Bully Bay*; the *Acaja* of the *Braſilians*, and *Icaco* Plumm-Tree, that has this peculiar, that thereon Birds as big as Jays, with black & gold-colour'd Feathers build their pendulous Neſts. The *Rhamnus*'s from *Maderaſpatan*, and the Trifoliate *Sumachs* from the Coaſt of *Africa*, are altogether new.

Two ſorts of *Folliculiferous* Willows from *Barbados*, and the *Saſſafras-Tree*, with its Fruit, whoſe Flowers are like the male *Cornel*, of which for many Reaſons it may well be eſteemed a Kind. Its leaves break with araneous filaments, like thoſe of ſcabious, which is proper alſo to the *Cornels*. It flowers early in the Spring, before its Leaves begin to put forth, ſo does the *Cornel*; nor are their Fruit and Qualities unlike. Our Author takes this to be the ſame with the *Lignum Auiſi ex Orbe Atlantico advectum Goropii Hiſpan.* lib. 7. An Ironwood from the *Cape*, and another from *Barbados*, which as it is the ſame mentioned in *Ligon*. It may alſo be the *Sideroxylum Charibbæarum mucronatis foliis Ogilb. Americ.* 371.

There are no leſs than ſeven ſtrange *Siſyrichia* from *Africa* and *Ceylon*, a moſt elegant *Syringa* with winged Leaves like Aſh, ſcandent, and with Claſpers, from *Maderaſpatan*. A golden-flower'd *Telephium*, from the *Cape*. The

Techomahae-Tree from *Mexico*. Three ſtrange *Therebinths*, the *Palamalatta dicta*, that with the Leaf of a Roſe-Tree, and a trifoliate kind; the *Palamalatta vulgo*.

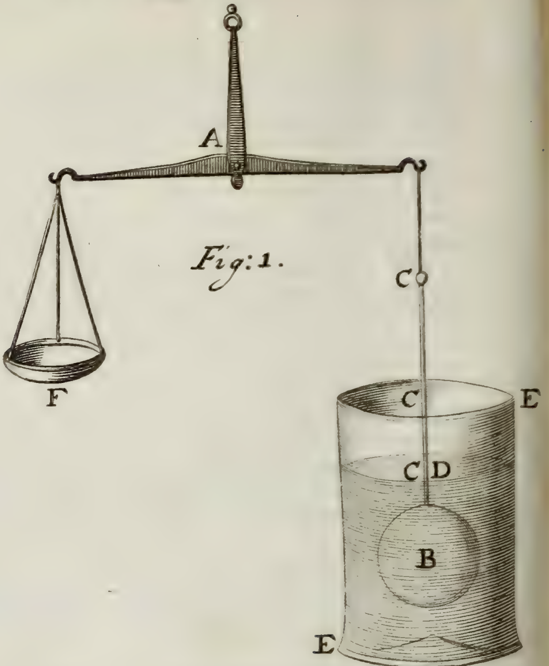
Various *Thymelæa*'s hitherto unknown, from ſeveral parts of the World, and *Tithymals* in abundance, from *Ceylon*, *Mauritania*, *Æthiopia*, *Monomotapa*, and the Iſland of *Curaſſau*. There is an Arboreſcent ſort with a very large Leaf, no leſs venomous than the *Mancinello*, this is the *Tetlatia* of *Euſebius Nierembergius*, and by thoſe of *Barbados* called the *Poyſon-Tree*. Another kind there is, called by ſome rhe *Mancinello Sylveſtris*. There is a pretty ſort of *Trifolium Sapinum*, from *Maderaſpatan*, with ſomewhat long Pods. This our Author thinks to be a Kin to *Lotus*, and may perhaps be a kind of that *Melilotus Syriaca ſ. Chalepenſis major coronata ſiliquis biuncialibus* Moriſon. *Icon.* Sect. 2. Tab. 16. Num. 13. As for *Viola*'s and *Virga aureas*, they are ſo uumerous, and yet ſo new, that I muſt refer you to the Tables themſelves; the *Vvifera*'s are very curious indeed, and ſeveral ſtaining Woods from *Barbados* are very deſerving a more particular Remark; as alſo the prickly *Xanthium* from the Kingdom of *Portugal*. But I am obliged to haſten, and therefore I draw up all into this Concluſion; That ſure it muſt needs be a great Pleaſure to ſuch curious Perſons that have addicted themſelves to the Botanick Studies, to ſee how far the Art it ſelf has been cultivated and improv'd. By the ſingle effort of an unaſſiſted Induſtry, and how capable it is of farther Improvements, would the Age but propoſe a ſuitable Encouragement.

The Work is follow'd by an Explication of the abbreviated Names of Gardens, Books, and Authors, made uſe of in the Tables, as alſo a general *Index* to all the Three Parts of *Phytographia*.

Of the Firſt and Second Part of the Authors *Phytographia*, publiſhed in the year 1691. there was an Account given in the *Philoſophical Tranſactions*, N°. 193.

LONDON:
Printed for, and Sold by *Samuel Smith*, Printer to the *Royal Society*, at the *Prince's Arms* in St. *Paul*'s Church-yard, 1693.

Philosophical Transaction N°. 197.



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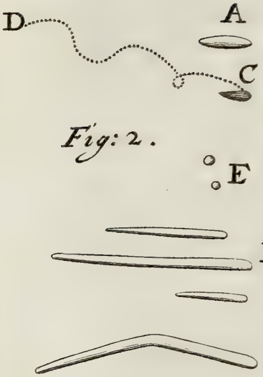

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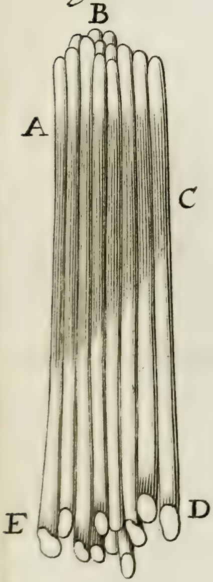

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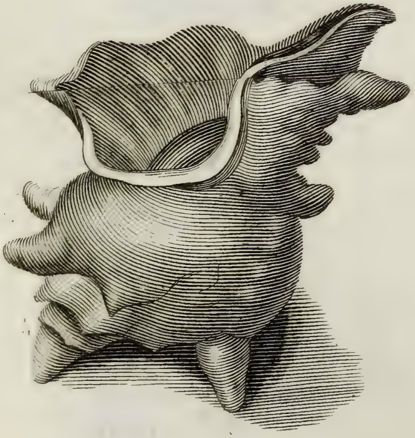

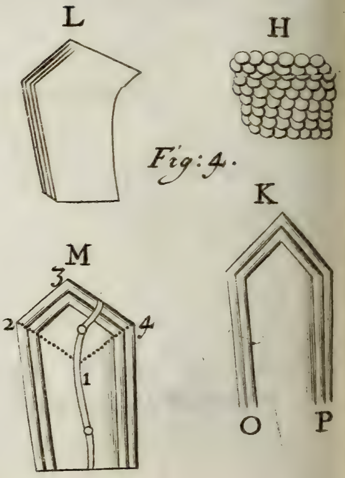

Fig: 4.

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PHILOSOPHICAL TRANSACTIONS.

For the Month of February, 169$^{2}_{3}$.

The CONTENTS.

1. *Some Experiments on a black ſhining* Sand *brought from* Virginia, *ſuppoſed to contain Iron, made by the late Dr.* Allen Moulin, *R. S. S.* 2. *A Paper of the* Honourable Robert Boyle's, *late Fellow of the Royal Society, being an Account of his examining Waters as to Freſhneſs and Saltneſs; together with an account of the Trials made of the ſame at a Meeting of the* Royal Society, *by* Hans Sloan, M. D. *and* S. R. S. *To which is ſubjoyned another Method of making ſuch Diſcoveries by the help of a Particular kind of* Water-Poiſe, *by* Robert Hooke, M.D. *and* R. Soc. Soc. 3. *Three* Quæries, *concerning ſome* Shells, *uſed in* Medicine, *propoſed by Mr.* Samuel Dale, *and anſwered by* Martyn Lyſter, M. D. *and* R. Soc. S. *with a Figure of the Shell yielding the* Purple *of the Ancients.* 4. *The Abſtract of a Letter from Mr.* Anth. Van. Leeuwenhoek, *R. S. S. to the Royal Society, containing ſome Microſcopical Obſervations on ſmall Animals, breeding on the out-ſides of the Teeth; and on the Scalineſs of the* Scarf Skin, *&c.* 5. *An Account*

count of ſeveral Experiments made to examine the Nature of the Expanſion and Contraction of Fluids by Heat and Cold, in order to aſcertain the Diviſions of the Thermometer, *and to make that Inſtrument, in all places, without adjuſting by a Standard. By Mr.* Edm. Halley, *S. R. S.* 6. *An Account of a Book*, viz. *Novæ Hypotheſeos* ad explicanda febrium intermittentium Symptomata & Typos excogitatæ, Hypotypoſis, unà cum ætiologiâ Remediorum ; ſpeciatim vero de curatione per *Corticem Peruvianum*, acceſſit Diſſertaticuncula de Inteſtinorum motu Periſtaltico. Authore Guilielmo Cole *M.D.* Imp. Lond. in 8°. 1693. Proſtant apud *S. Smith.*

I. *Some Experiments on a Black Shining Sand brought from* Virginia, *ſuppos'd to contain Iron, made in* March 1689. *By* Allen Moulen, *M. D. and Fellow of the Royal Society, ſince Dead.*

1. A Small Phial fill'd with ordinary white Sand, and containing only ʒ*j. gr. xj.* being fill'd with the *Virginia* Sand was found to contain ʒ*ij*,℈*ij, gr. j*, that is, ʒ*jß.* more than what was equal to it in bulk.

2. This Sand did apply to the *Magnet* both before and after Calcination, but the latter did apply better to it than the former.

3. A parcel of this Sand mix'd and calcin'd with powder'd Charcoal, and kept in a melting Furnace for about an hour, yielded no *Regulus*, but apply'd more vigorouſly to the Load-ſtone than either of the former.

4. I flux'd a parcel of this Sand with fix'd Nitre in a melting Furnace for above an Hour, but could obtain no *Regulus*, nor any ſubſtance that would apply to the Magnet, excepting a thin Cruſt that ſtruck firmly to a piece of Charcoal that dropt into the Crucible when the matter was in fuſion.

5. I flux'd it alſo with Salt-Peter and powder'd Charcoal, dropping pieces of Charcoal afterwards into the Crucible. It continu'd about an hour in the melting Furnace in fuſion, and that without producing a *Regulus* or a Subſtance that would apply to the Magnet, excepting only what ſtuck to the Charcoal, as in the former Experiment.

6. I flux'd another parcel of it with Salt-Peter and Flowers of Brimſtone, without being able to procure any *Regulus*.

7. I pour'd good Spirit of Salt on a parcel of this Sand, but could obſerve no Luctation thereby produc'd.

8. I pour'd Spirit of Nitre both ſtrong and weakned with Water on parcels of the ſame Sand, without being able to diſcover any Conflict.

9. I pour'd ſingle *Aqua fortis* upon another parcel of it, without being able to perceive any Ebullition worth noting.

10. I pour'd double *Aqua fortis* upon another parcel of it, which for ought I could diſcover had no more effect on it then the former.

11. I pour'd alſo ſome *Aqua Regia* on a parcel of it, without diſcovering any ſenſible Effect.

12. I pour'd good Oil of *Vitriol* upon another of this Sand, but ſeeing no Bubbles thereby produc'd, I weakned the Oil with Water, but without any ſenſible effect.

13. I repeated all the former Experiments with the *Menſtruums* upon this Sand after Calcination *per ſe* in a Crucible, but could ſcarce obſerve a Bubble produc'd by any of them.

14. I pour'd ſome of each of the Liquors upon Parcels of the Powder of this Sand calcin'd, without any Succeſs.

Note, That I made theſe Experiments both in the Cold, and upon a Sand Furnace. So that to me there ſeems to be but little wanting to diſcover any Metal known to us, if it contain'd any ſuch: For there is no Metal nor Oar that ſome of theſe *Menſtruums* will not work on.

15. I powder'd a Fragment of a Load-ſtone, and pour'd ſome of theſe *Menſtruums* upon it, without being able to find that they in the leaſt prey'd upon it, any more than they did upon the Sand.

16. I pour'd ſome of the afore-mentioned *Menſtruums* upon ordinary Sand taken out of a Sand Furnace, where it muſt have ſuffer'd ſome Calcination, but could find no more Bubbles produc'd thereby, than what might rationally be ſuppos'd to be produc'd from time, and other Dirt mixt with the Sand.

II. *An Account of the Honourable* Robert Boyle's *way of examining Waters as to Freſhneſs and Saltneſs.*

To be Subjoyn'd as an Appendix to his lately Printed Letter about Sweetned Sea-Water, Octob. 30. 1683.

I. Having, ſince the Publication of the foregoing Letter, been commanded by the King, to ſhow His Majeſty an Experiment of the way herein mention'd, to examine the Freſhneſs and Saltneſs of Waters; I did in His Preſence, (and that of his Royal Highneſs, his Grace the Duke of *Grafton*, and ſeveral Perſons of Quality) make tryal of it, both upon ſome Water prepar'd according to the Patentees way, and upon two or three Natural Waters, that were order'd to be brought. In all which Tryals, (in ſome whereof his Majeſty, for greater certainty, was pleaſed to employ His own Hands) the Succeſs was ſuch, as mov'd him to vouchſafe the Experiment the Honour of his ſpecial Approbation, and to give me an encouraging Permiſſion to communicate it, as a thing that may prove not unuſeful to the Publick. This I think fit to mention, not only to procure to my way of trying Waters, the high Advantage of a Royal, and, (on Philoſophical Accounts) Illuſtrious Patronage; but that, if this Method be found as beneficial as I wiſh it may, Men may know to whom they ought to acknowledge the early Publication of it. This is all my Haſt allows me to premiſe, to the Account I am going to deliver, of the way of trying Waters hitherto ſpoken of: which Account I ſhall ſet down, as I drew it up to be diſpatch'd to a Friend *, in caſe I ſhould have his Majeſty's permiſſion to impart it to him.

N.B. This Paper was depoſited with the Secretaries of the Royal Society, *An.* 1683. ſealed up and opened ſince the Authors Death.

* Which ſhould have been to the worthy Doctor *John Beal*, to whom the Letter this Paper refers to was written; but to the Authors Grief, and the great loſs of the Commonwealth of Learning, he died before this Paper was written.

II. My way of examining the Freſhneſs and Saltneſs of Waters, *tho'* (becauſe it is wont to be ſurprizing the firſt time one ſees it try'd, and has had the luck to be much talk'd of in many good Companies) 'tis thought to be an Invention very difficult, to be either found out or practis'd, is *yet* really no ſuch myſterious thing as Men imagine it. And for my part, I hope it will be found much more conſiderable for its uſe, than I think it is for the degree of Skill and Sagacity, that was neceſſary to deviſe it. For when I remembred and conſider'd, that (as I have found by various Trials) divers Metalline, and other Mineral Solutions could be readily precipitated, not only by the Spirit of Salt,but by crude Salt, whether dry or diſſolv'd in Water, 'twas no very difficult matter for me to think, that by a heedful application of the Precipitating Quality of common Salt, one might diſcover whether any Particles of it, (at leaſt in a number any way conſiderable) lay conceal'd in a diſtill'd Water, or any other propos'd to be examin'd.

III. To find whether I was not miſtaken in this Conjecture, as alſo becauſe it is very convenient to be as little as one can confin'd to one Material, I employ'd ſeveral Drugs, and thoſe not all prepar'd by one *Menſtruum*, to make the intended Diſcovery. And, tho' two or three of my other Trials had Succeſſes, that I diſlik'd not when I made them,yet that which at length I pitch'd upon as the moſt certain, and which therefore I meant, when I had the Honour to be ſent for by his Majeſty about the Patentees Water, was that which I think may be beſt underſtood, as well as recommended, by this ſhort Narrative.

IV. I took ſome common Water diſtill'd in Glaſs Veſſels, that it might leave its Corporeal Salt, if it had any, behind it, and put into a Thouſand Grains of it, one Grain of dry common Salt: Into a convenient quantity, for Example, two or three Spoonfuls, of this thus impregnated Liquor, I let fall a fit proportion, for inſtance Four or Five drops, of a *very ſtrong* and well filtrated Solution of well-refined Silver, diſſolv'd in clean *Aqua Fortis*; [for a ſhift, common or Sterling Silver will ſerve the turn:] And I made the Experiment ſucceed with Spirit of Nitre, inſtead of *Aqua fortis*, upon which there immediately appear'd a whitiſh Cloud, which tho' but ſlowly, deſcended to the bottom, and ſettled there in a white Precipitate. *N. B.*

V. This Experiment having been ſeveral times, for the main of it, reiterated with Succeſs, I thought fit to keep conſtant to the way of Probation I made uſe of in it, (and which Trials had recommended to me for between 20 and 30 Years) tho' (by reaſon of ſome things that Haſt forbids me to mention) I pitch'd upon this way without at all denying, that Men of Sagacity, eſpecially if well vers'd in Chymical Operations, may upon the ſame ground that I went upon, find ſome other and cheaper ways, tho' ſcarce any more nice and certain, of compaſſing the ſame end.

VI. After what has been hitherto ſaid, I preſume I may ſeaſonably proceed, to ſubjoyn the four enſuing Advertiſements.

And *Firſt*, I ſhall give notice, that, to make the Experiment rather ſeverely, than at all favourably, there was uſually taken ſomewhat more than a thouſand parts of Water to one of Salt.

VII. *Next*, I obſerv'd, that having let fall a few drops of our Metalline Solution, into the Liquor obtain'd from Sea water by the Patentees way of Sweetning it, there did not preſently enſue any white Cloud or precipitate, much leſs ſuch an one as had been newly afforded by the Water, that was impregnated with leſs than a thouſandth part of Salt. And if after ſome time there *happen'd* to appear (for 'tis not abſolute neceſſary it ſhould) a little Clowdineſs in this Factitious Liquor, it was both ſlowlier pro-

duc'd,

duc'd, and much leſs, than that which appear'd in the impregnated Water *.

IX. Thirdly, The Uſefulneſs of this Experiment is not to be eſtimated only by the *Examen* it helps us to make of dulcify'd Sea-water, but much more by the Eſtimate, that by its means may be made of natural Freſh Waters, whether of Springs, Rivers, Clouds, Lakes, Wells, *&c.* For it being generally granted, that thoſe Waters, *cæteris paribus*, are the beſt, as well for the Wholſomneſs, as divers Oeconomical Uſes, as Waſhing, Brewing, *&c.* that are freeſt from Saltneſs, which is an adventitious, and in moſt caſes, a hurtful Quality in Waters; by our way of examining theſe Liquors, a heedful Eye may in a trice diſcover, whether there be any latent Saltneſs in them, (as moſt Waters imbibe from the Soyl they have traverſ'd, or do ſtagnate in) and may enable one, eſpecially by the help of a little Practice, to give a near gueſs, how much one Water is freſher than another, as I have purpoſely try'd with pleaſure in differing Waters, that were ordinarily drunk, even by conſiderable Perſons. And if once you have attentively mark'd, what change Four or Five drops, for inſtance, of our diſcovering Liquor, will make in two or three, or ſome other ſmall determinate number of Spoonfuls, (or rather of half Ounces) of Water ; 'twill not be difficult for a heedful Obſerver, keeping the ſame proportion between the two Liquors, to make a near Eſtimate, *whether* any Natural Water propos'd to him, have a greater, an equal, or a leſſer degree of Freſhneſs or Saltneſs, than that Water that he has choſen for his Standard ; and *how much*, in caſe there be a difference, the propos'd Liquor is leſs or more free from Saltneſs than the other.

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* VIII. And perhaps it may be proper, that I here obſerve (what is not wont to be taken notice of) That divers Solutions of Mineral Bodies may be Precipitated by *Dilution*; that is, (to explain this Expreſſion) when the Solution has time enough allow'd to diffuſe it ſelf, through a great quantity of Water, the Saline Parts are thereby ſo diluted and weakned, that they are no longer able to ſuſtain the Mineral Corpuſcles, they kept ſwimming before, but make with them, and the Water, a confus'd and ſubſiding Mixture, uſually of a whitiſh colour. This may appear when the Butter of Antimony, being put into common Water, is thereby quickly and plentifully precipitated in the form of that white Powder, that Chymiſts (not over-deſervedly) call *Mercurius Vitæ*. To which I way add, that I have alſo produc'd a Powder of that colour, by pouring into common Water a ſtrong Solution of Tin Glaſs made in *Aqua Fortis*. And by the ſame way we have precipitated the Tincture (or Solutions of the finer Parts) of Jalap, Benjamin, true Labdanum, Antimonial Sulphur, and divers other Bodies made in Vinous Spirits. If it were not for this Power, that Water has to weaken moſt Solutions of Bodies, I could have employ'd inſtead of that Silver, either Quickſilver diſſolv'd in *Aqua fortis*, or Lead crude or calcin'd, in the ſame Liquor, or (which is more convenient) in ſtrong Spirit of Vinegar; ſince theſe, and ſome others, are found to be precipitable by Salt Water into whitiſh Powders. But *tho'* a very heedful Obſerver may for a ſhift, make uſe of theſe Metalline Solutions, to gueſs at the Quality of Water, as to Freſhneſs and Saltneſs; *yet* the Precipitation that is made by *Dilution*, is not difficult to be diſtinguiſh'd, from that which is perform'd by a true and proper *Precipitant*, (as in our caſe by the common Salt, that is harbour'd in the Pores of the Water) both by the *quickneſs* of the Effect, and the *copiouſneſs* of the white Subſtance produc'd, and on both thoſe accounts is very much inferiour to it; as may evidently appear in the very different Effects that our Solution of ——— ——— had upon the Patentees Water, or upon well diſtill'd common Water, compar'd with thoſe it had upon Water impregnated with a thouſandth part of Salt, and upon divers common undiſtilled Waters. This Advertiſement I have plac'd in the Margent, as not thinking it fit either to omit it, or by inſerting it in the Body of the Writing, to give too great an Interruption to the Series of my Diſcourſe.

X. And that (to add this upon the by) ſuch a difference in a Liquor of ſuch frequent inward Uſe as Water (which is the *Baſis* of Beer, Ale, Mead, and ſome other common Drinks) may have conſiderable Effects upon Humane Bodies in reference to Health, may be probably argued from the differing Effects that Waters more or leſs impregnated with Salt, have upon divers other Bodies. Since moſt Pump-Waters, for inſtance, will not boyl Peas and Beef, and ſome other Aliments, near ſo well as Spring Water or Rain Water, which are uſually ſofter, and more free from the Saltneſs we ſpeak of. 'Tis commonly known to Barbers and Laundreſſes, that the ſame Pump-Water will not ſo well and uniformly, or without little Curdlings, diſſolve Waſh-balls and Soap, as Rain-Water, and ſome running Waters uſually will : Nay, when I was curious of tempering Steel, I remember 'twas confeſs'd by the skilfulleſt Artiſts I made uſe of, that ſome Tools, (as Gravers, &c.) made of that hardeſt of Metals, would receive a differing Temper if they were quench'd in Pump Water, from that which the like Extinction in Spring Water, or River Water, would give them. But how to make our Eſtimate of the Freſhneſs or Saltneſs of Water come *neareſt* the Truth, is a

Problem, of which I have now neither time nor conveniency enough to deliver my Thoughts. And by what has been ſaid, I hope it does already ſeem ſufficiently probable, that the way above propoſed may prove of good uſe, both to Navigators, that are often neceſſitated to Water in unknown places, and to others that only, or frequently drink that Liquor, without having any better way than the Taſte, (which is but an incompetent one) to eſtimate its Freſhneſs and Saltneſs by *.

XII. Fourthly, (and Laſtly) tho' both in my Letter to Dr. *I. B.* and in this preſent Poſtſcript, I did not for certain Reaſons aſcribe to our Method of examining Waters, a greater Nicety than to be able to diſcover one part of Salt in a thouſand of Water, that Proportion being great enough to recommend it, and expreſs'd by a round number eaſie to be retain'd in ones Memory: Yet I would not have it thought but that, if it were requiſite, our Method may make more nice Diſcoveries. For, having ſometimes for Curioſities ſake, put one Grain of Salt into no leſs than Fifteen Hundred of diſtilled Water, we could manifeſtly, (tho' not quite ſo conſpicuouſly as before) make it appear by our way, that even this ſo lightly impregnated Liquor was not devoid of Salt, but had more of that in it, than ſome of the Patentees Water that I kept by me had; nay, I once found, that a Grain of dry Salt, being diſperſed through two thouſand, and another

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* XI. I might add on this occaſion, That, whereas Experience has inform'd ſeveral Perſons who have conſulted it, that divers Medecinal Waters, that are preſum'd to owe their Vertues to the participation either of Metalline, or of other Mineral Bodies, do upon trial appear to leave ſometimes little, and ſometimes nothing behind them, except a kind of common Salt; our Precipitant may much aſſiſt Men to diſcover, *whether* a mineral Water propos'd to be examin'd, do, or do not contain, ſuch a Salt; and if it do, *whether* it contain it copiouſly or no. This I have try'd upon more than one of our Engliſh mineral Waters, and thereby found in a trice, that one that is reputed of another nature, contain'd pretty ſtore of Saline matter; and that another (which is ſtill, for ought I have learn'd, of an unexamin'd and unknown Nature) is impregnated with a ſurprizing Plenty of Saltiſh Subſtance. But how and with what Cautions, our Precipitant may be the moſt uſefully employ'd, about the Examen of medicinal and other mineral Waters, belongs not to this place, (but to || another Paper.) Upon which account I forbear to declare the uſe I have ſometimes made of our Precipitant, in examining the freſh Urine of Men, the *Serum* of Humane Blood, and other Bodies belonging to what the Chymiſts call the *Animal Kingdom.*

|| *About the Examen of* Mineral Waters.

time that being diſſolved in three Thouſand times its Weight of the ſame kind of Liquor, ſo inconſiderable a proportion of Salt was plainly diſcoverable by our Precipitant.

XIII. But here Philoſophical Candour forbids me to conceal an Objection that I made to my ſelf, though it be the chief, if not the only conſiderable Scruple that occur'd to me, about our way of examining Waters. For I foreſaw that it may be objected, that, whereas the Experiments hitherto mentioned have been try'd only upon Waters impregnated with groſs or corporeal Sea-Salt, this perhaps may not hinder, but that they may be imbued with the Spirits of Marine Salt, which by reaſon of their activity, may be as unhealthful to the Drinker, as the groſſer Salt it ſelf. But tho' to this Surmiſe I might anſwer, that a very ſmall Proportion of Spirit of Salt, may in many caſes make the Water ſeaſon'd with it, rather Medicinal than unwholſom; *yet* I ſhall anſwer more directly to the Objection, by ſaying, that to manifeſt it's not being well grounded, I took above a thouſand Grains of diſtill'd Water, and, inſtead of corporeal Salt, put to it one ſingle drop of *moderately ſtrong* Spirit of Salt, (for I had *much ſtronger* by me, that I purpoſely declin'd to employ) and having ſhak'd it into the Water, I let fall into a Portion of this unequally compos'd Mixture, ſome drops of our Solution of Silver, which preſently began to precipitate in a whitiſh Form; inſomuch that, for ought appear'd to the Eye, this Trial ſucceeded better, than if the Water had been impregnated with but a thouſandth part of Corporeal Salt. The like Experiment was made with the Patentees Water inſtead of the other. And to purſue this Trial a great way further, I had the Curioſity to diffuſe one drop of Spirit of Salt into two thouſand Grains of diſtill'd Rain Water; and upon letting fall ſome drops of our Precipitant into it, I found that the Succeſs well anſwer'd my Expectation. And then, to urge the Trial yet further, I added as much of the ſame diſtill'd Rain Water, as by a modeſt Conjecture made it amount to at leaſt half as much more. So that one Grain of Spirit of Salt had a manifeſt Operation, tho' not quite ſo conſpicuous as the former, upon above three thouſand Grains of Water, whoſe Immunity from common Salt we try'd apart;) and poſſibly, if the Vial could have contain'd more, and would not have been, when fill'd, too heavy for our tender Ballance, the Diſcolouration of the Mixture would have been diſcernable, tho' but one Grain of Spirit of Salt had been put upon Four, or even Five Thouſand Grains of Water. And that a drop of the Saline Spirit we made uſe of, did not equal in weight a grain of dry Salt; I found by this, that having let fall into a counterpois'd piece of Glaſs, ten drops of that Spirit, I found them to want near half a Grain of nine Grains weight; which way of eſtimating I choſe, as leſs ſubject to any conſiderable Error, than that of weighing a ſingle Drop by it ſelf.

XIV. The like Trial I made by ſubſtituting above a thouſand Grains of Rain Water, in the room of the like quantity of diſtill'd Water. And theſe two Experiments I the rather mention, becauſe they do not only ſhow how free the Patentees Water was from Spiritous, as well as from Corporal Sea-Salt; but alſo manifeſt that, whereas it is the Opinion of ſome Sea-men, and of a Perſon, for whom I have a profound reſpect, that Water ought to have a little ſaltiſhneſs to preſerve it; if this be really a deſirable Quality in our Artificial Water, it may in a trice be ſupply'd with as much Saltneſs, whether Corporal or Spirituous, as ſhall be requir'd, and conſequently as will bring it to be equal in that quality to the common Water of Rivers, or of Springs. And perhaps 'twill not be impertinent to add on this occaſion, that in ſome places, eſpecially lying in hot Climates, it may ſometimes be of good uſe to know, whether on the account of the Sun's Heat, or that of the Subterraneal Regions of the Earth,the Rain-Water is impregnated with Volatile (not Acid) Spirits, like thoſe that are diſtill'd from Urine, and which I have for Curioſities ſake, obtain'd from a Mineral Body, native Sal-armoniac; upon which account I made a Trial, that inform'd me, that if Five or Six drops of ſtrong Spirit of Urine (whoſe drops I obſerv'd to be but ſmall) were ſhaken into a thouſand Grains at leaſt of diſtill'd or Rain Water, impregnated with but one of Salt, our Precipitant would make a Diſcovery of ſome Saltiſhneſs in the Liquor. And it were neither to be admir'd nor cenſur'd, if the Patentees Water ſhould ſometimes ſhow a Change, when our Precipitant is plentifully put or long kept in it, eſpecially that Change being a more light one, than that I came from ſpeaking of. Since, for ought I have yet obſerved, not only ſuch undiſtill'd Waters as are generally allow'd to be freely potable, but even thoſe that Nature her ſelf diſtils, are not always quite devoid of Saltneſs. For I have found Rain-Water that I caus'd to be carefully ſav'd, after the Houſe-tops had newly been well waſh'd with former Rain, to grow a little troubled, if any ſtore of our Precipitant were kept for ſome competent time in it. And being gently diſtill'd off, it left a reſidence, which with a little of our Solution afforded a far more ſuddenly made and copious Precipitate, than had been produc'd with the like quality even of Pump-Water it ſelf. And, *tho'* I have met with Rain-Water that was more free from Salt than any Spring or River-water that I remember, I have examin'd; yet, having for Curioſities ſake made Trial of Snow-Water, (which if the Weather had been ſomewhat milder, would have been Rain) this Liquor, I ſay, which is thought to afford the lighteſt Water of all natural ones, I manifeſtly found by our way of examining it, not to be devoid of Saltneſs.

XV. But to return to the Trial we made with the Spirit of Salt; theſe Experiments may not a little confirm the Freſhneſs of the Patentees Water. And whereas ſome have either really ſuſpected, or invidiouſly pretended, that even a moderate Action of the Fire upon Water, will make it brackiſh and putrifie: As I ſee no ſubſtantial grounds of this Surmiſe, ſo it appears by the foregoing Trials, that really the Patentees Water is not brackiſh, but is more free from Saltneſs, than moſt of the Waters Men do without ſcruple drink: And if it were true, that this Water ſhould not keep quite ſo long as others, yet that were no more than is objected (how truly I now enquire not) to the Generality of diſtill'd Waters: And that this we ſpeak of, may keep ſweet longer than is neceſſary in a Ship, that can from time to time, within a few days ſupply it ſelf with freſh out of the Sea, may be gather'd from theſe two things. The *Firſt* is, That to ſatisfie my ſelf, whether cloſeneſs would make the prepar'd Water ſoon putrefy, (as ſeem'd obvious to be ſurmis'd) or at leaſt afford Dregs, I caus'd a Pint, or a Pound of it, to be hermetically ſealed in a Vial, whereof I left by gueſs about a third part empty, and having above ſix Weeks after held this Veſſel againſt the Light, I found the Water to be clear and limpid; tho' I did not judg it had depoſited ſo much as the tenth part of a Grain of Feculency. And having open'd the Seal, and taken out a little of the Liquor, I did not find it alter'd, either as to Smell or Taſte. The *Second* of the two things that were to be mention'd, is, That I have kept the Bottle of prepar'd Water mentioned in my Letter to Dr. *Beal*, in the ſame unſtopt Veſſel ever ſince *March*, that is ſo long, that 'tis now near eight Months old, and yet it continues ſweet and well condition'd. And, if that which is called Crudity in Water does conſiſt, (as probably it often times does) in certain groſs Particles that are mingled with the purely aqueous ones, it is likely, that the Action of the Fire may divide and diſſipate theſe into Minuter Particles, and thereby deſtroy the Texture that makes them hurtful; and by cauſing innumerable tumblings and rovings among the more earthy Particles, give them opportunity to make little Coalitions, whoſe weight precipitating them to the bottom, frees the pure Water from them.

XVI. And becauſe 'tis but too probable, that the unwholſomneſs of divers Waters proceed, not only, or perhaps not ſo much, from bare Crudity, as from a great quantity of groſſer Particles, that are not eaſie to be rais'd, becauſe of their being combin'd with fixt and earthy ones, that ſwim up and down in the Water they impregnate, as Silver or Mercury does in a Solution made with *Aqua fortis*, or rather as the Particles of Salt do in Pump-water, and many other common Waters: On this account I ſay, the Patentees Invention may very much correct ſuch Waters, ſince by their way of ſweetning thoſe Liquors, the truly Aqueous Parts are not only freed from the Saline ones, but from the Mineral, and other groſs and hurtful Corpuſcles that may have lain conceal'd in the Liquor. As may be argued from hence, that having purpoſely in the gentle Fire of a digeſtive Furnace, ſlowly diſtill'd off a Pound of the Patentees Water, it left us in the Cucurbit ſo light and thin a Feculency, that the bottom of the Glaſs ſeemed to be rather ſullied than cover'd by it; and I did not judge that the whole Feculency, if we could have got it out, would have amounted to ſo much as two Grains.

XVII. But to return, after this ſhort, and I hope not impertinent Digreſſion, to what I was lately ſaying, of the Vertue of the Fire, to correct the Crudity of Waters; I ſhall proceed, and ſay, that perhaps 'twas upon ſome ſuch Reaſons, (to which others might be added, if I could in few Words confirm Paradoxical ones) that the laſt Great Duke of *Tuſcany* when he drank Water, (for it was not, as I perceive ſome have miſunderſtood, his only Drink) prefer'd for wholſomneſs that which was diſtill'd to that which was not ; and if herein that Learned Prince, and thoſe of the ſame Opinion, were not miſtaken, it will highly recommend the uſefulneſs of the Patentees Invention to Mankind: For I ſhall on this occaſion obſerve, that there are multitudes of Waters that are not conſiderably brackiſh to the Taſte, that yet, by reaſon of ſome unheeded Saltneſs, as in moſt Pump-waters, are more frequently, by reaſon of Crudity, are not only unfit, or (at beſt) leſs fit, for divers Oeconomical Uſes, as Waſhing, Boyling of ſome Meats, *&c.* but are very unwholſome; ſometime to a degree, that makes them miſchievous to whole Communities, and perhaps Nations. Of this 'twere to be wiſh'd, that it were harder to give Inſtances. I remember I have ſeen a notable one, in thoſe hugh and unſightly Tumors about the Throat, which are obſerv'd by Travellers to be exceeding common, among thoſe that inhabit the lower Tracts of Ground that lie between the *Rhætian*, *Helvetian*, and ſome other neighbouring Mountains; which monſtrous Swellings are generally imputed to the Snow Waters that flow from the Mountains, and make the uſual Drink of the meaner ſort of People ; whence 'tis obſerv'd, that Perſons of better condition, who drink Wine more than Water, are either not at all, or far leſs troubled with theſe disfiguring *Goitres*, (as they call them.) But much more notable inſtances to our preſent purpoſe are afforded me by that Great, (and yet living) Traveller *Monſieur Tavernier* (Baron of *Aubonne*) who ſpeaking of a Nation of *Cafres* or *Negroes*, that comes ſometimes to trade with the *Portuguez* from a remote part of *Africk*, informs us, *That the Water of their Country is very bad, which is* (ſays he) *the reaſon that their Thighs do ſwell, and it is a wonder to ſee any one of them free.* Nay, which is far more, where he ſpeaks of the *African* Kingdom (or

Tavernier's Travels. *Part* II. *Book* II. *chap.* 23. *pag.* 156.

or Empire) of *Monomotapa*, he has this memorable Paſſage, *The Natives never live long, by reaſon of the badneſs of the Waters in the Country. For at the Age of Twenty Five they begin to be Dropſical, ſo that 'tis a great wonder if any among them live above Forty Years.*

XVIII. What *Monſieur Tavernier* delivers being taken for granted, it ſeems very probable, that theſe People may be much reliev'd, and be brought to live as long as other Nations, if they had ſo compendious a way as that of the Patentees, to provide themſelves plentifully with Waters, whoſe Crudity is corrected, its groſſer and heavier parts ſeparated, and its brackiſhneſs deſtroy'd by the Fire, as its Action is regulated and help'd by their Invention.

The Experiment mention'd in this Paper was try'd at a meeting of the *Royal Society*, *Feb.* 17. 169$\frac{2}{3}$. by Dr. *Slone*, with a Succeſs anſwerable to the Aſſertions of the *Honourable Author*, and that a drop or two of Spirit of Salt mixed with common Water, would be by the ſame Method diſcovered.

At another meeting of the ſaid Society on the 2d of *March* following, Dr. *Hooke* read a Lecture concerning another Method of his own for the diſcovering the ſmalleſt quantity of Salt contained in Water, from a Principle of *Hydroſtaticks*; and after his Diſcourſe thereof, he producod the *Apparatus* which he had prepared to exhibit the ſame before the Perſons then preſent; and it was there ſhewn, that the Iuſtrument he apply'd to that Scrutiny did very evidently diſcover the Mixture of a 2000th part of Salt added to common Water, and would eaſily have detected half that quantity of Salt added to an equal quantity of Water, as was judged by thoſe that obſerved the Succeſs thereof.

The Method of doing which Operation was by means of a large Poiſe of Glaſs, ſomewhat of the ſhape of a Bolt-head, the Ball of which was about 3 Inches Diameter, but the Stem or Neck thereof was not above half a Line, or a twenty fourth part of an Inch; this was ſo poiſed by Red Lead put into it, as to make it but a little heavier than fair, or freſh Water. Then this Poiſe was ſuſpended by the ſmall Stem to the end of a ſlender Beam, which was very tender, and being not over-charged with weight, would turn with a ſmall part of a Grain. This Beam was hung on a ſteady Frame, and the Poiſe hanging at one end of the ſame, cover'd with the Water to a certain Mark or Diviſion made on the ſmall Neck, it was ſo counterpoiſed by ſome ſmall Weights put into the oppoſite Scale of the Ballance. Then (the weight of the Water contained in the Ciſtern or Veſſel into which the Poiſe was immerſed being firſt known) a 2000th part of it's weight was taken of common Salt weighed out,and put into the whole 2000 parts of the Water, which by being ſtirred ſoon diſſolved. Then the Poiſe ſuſpended as before, was viewed and examined by many then preſent, and they manifeſtly ſaw that near half an inch more of the Neck emerged out of the Water ſo ſeaſoned, than did before the 2000th part of Salt was diſſolved therein, This was only one uſe of this Method of diſcovering very ſmall Alterations in the Conſtitutions of Bodies, the ſame Author having long ſince, namely, *October* 25. 1677. ſhewn to the ſame Society a Method of diſcovering divers Alterations much more curious, namely, to the 176000th part of it's weight.

This Deſcription will be more eaſily apprehended by the firſt Figure, where *A* ſignifies the Beam, *B* the Ball of the Poiſe, *C C* the Neck, *D* the Mark to which it ſunk in Freſh Water, *E E* the Ciſtern or Veſſel containing the Water, *F* the *S*cale wherein the Weights to counterpoiſe it were put.

III. *Three* Queries *relating to Shells propoſed by Mr.* Samuel Dale, *and anſwered by Dr.* Martyn Liſter. *R.S.S.*

The Queries.

THere are three things among *Shells*, in which I would be glad of Dr. *Liſter*'s Aſſiſtance, which if you can procure, will be a great Favour, and deſire it may be done as ſoon as poſſible.

1. *What is the* Entalia *of the Shops? by what Authors deſcribed? under what Names? and how they differ from the* Dentalia?

2. *Of what Shell is the* Blatta Byzantina *the* Operculum?

3. *There are divers ſorts of* Purpuræ *among Authors, which is that of the Shops? Likewiſe which ſort of* Buccina *and* Umbilici Marini *ought to be uſed in the Shops?*

The Anſwer to the Three Queries, by Dr. Liſter.

1. As to the *Entalia*, I do not remember to have ſeen any thing in the Shops under that Name. The Deſcriptions of the *Dentalia* in *Scroder* are very faulty, and both thoſe and the *Entalia* by him ſhould ſeem to be the Two *Species* of *Dentalia*, which are by me figured. The *Dentalium* being that which is commonly and in Plenty found about the Iſland of *Garnſey*, and elſewhere

where upon our Coaſt; and is the ſame with that found in the *Mediterranean.* It is a long, ſlender, round Pipe, a little bending and tapering, hollow and open at both ends, without any Crack or Flaw, naturally, white at one end, and uſually a little reddiſh; very ſmooth and poliſh'd on the out-ſide, and from thence and the Figure called a *Dog-like Tooth.* The *Entalium*, or other *Species* of the *Dentalia* is very much longer and thicker than the former, much alike in other reſpects, ſave that this is ſtreaked with high Ridges, and moſtly of a greeniſh Colour. This Species I gueſs to come from the *Indies.* Note, that any thing that is wrought into, or channeled, is in the Modern *Italian* called an *Intaglia*; whence I believe, and the nearneſs of the Word *Dentalia*, aroſe thoſe diſtinctions of Names.

2. To the Second *Quære*, I take the *Blatta Byzantina* to have ſucceeded the *Vnguis Odoratus*, and to have been brought into the Shops in its place. In *Dioſcorides*'s time the beſt was brought from the *Red Sea*, *viz.* the paleſt and fatteſt; the blacker, and leſs, from *Babylon* or the *Perſian Gulf*; but it ſeems later Times took up with thoſe found about *Conſtantinople*; whence the preſent Shop *Blatta* had its Name. The Name of *Blatta* is given to this *Operculum*, from the Colour I gueſs; as being of a dark Hair Colour, as the common *Blatta Piſtinaria*, ſo common in *London*, is; alſo this being a broad, thin, flat Beetle, like the Cover.

'Tis true, the ſame *Dioſcorides* ſays, the *Vnguis* was an *Operculum* (πῶμα χογχυλίον) like to that of the Purple Fiſh. He means what was uſed in his Time; in which it ſeems the *Vnguis Odoratus* was loſt, or was not brought to *Europe.* But it will appear out of the ſame *Dioſcorides*, that the *Vnguis* was no *Operculum.* It will be worth the while to make out this Miſtake, and conſequently the Errors the Moderns have been in to ſubſtitute an *Operculum* of a Marine *Turben* for the true *Unguis Odoratus*.

Take the Hiſtory of the *Unguis* out of *Dioſcorides*. ‘ It ‘ is found, ſays he, in the Lakes of *India* where *Narde* ‘ grows; wherefore the *Conchylia* feeding on *Narde* are ‘ *Aromatick*. It is gathered after that the Lakes are dried ‘ up with the Summer Heats. He concludes, the *Conchylium* it ſelf burnt or calcin'd, is of the ſame Efficacy ‘ with the *Purpura* and *Buccinum* burnt in the Chapter of ‘ *Narde*. He ſays farther, That the *Indian Narde* grew ‘ near the River *Ganges*, that is, in certain Lakes, which the over-flowing of that River cauſed. Hence it appears (1) That the *Unguis Adoratus* was part of a *freſh Water Conchylium*. (2) Now if it was gathered in the Nardiferous Lakes upon the River *Ganges*, how comes it to paſs that the ſame was brought out of the *Red Sea* and *Babylon*. And why ſhould the Shell it ſelf be brought, an uſeleſs Luggage ſo far, as from the River *Ganges* to *Greece*, the *Operculum* rarely being a Tenth part of the Shell it ſelf. Now if it was not uſed to be brought and expoſed to Sale, to what purpoſe to declare its Vertues, or how could the Experiment be made. I conjecture therefore, that the true *Unguis Odoratus* was ſomething like the half of a *Pectunculus Fluviatilis*, ſo common in the River *Thames*, of the bigneſs and thickneſs of my Thumb Nail, and that for theſe Reaſons.

1. That the *Unguis Odoratus* ſeems to have been a freſh-water *Bivalve* or Muſcle, for that they ſtay'd till the Lakes on the River *Ganges* were dried up before they gather'd them. Now *Bivalves* are ever buried in Sand and Mud, and never riſe up and ſwim about and float as the *Turbinate* Snails do, to which latter only the *Operculum* belongs, and which therefore were always, and eaſily to be caught.

2. He calls this Snail *Conchylium*, and by that general Name diſtinguiſhes it from all the other ſorts, concerning which he treats in ſeveral Chapters; which tho' in general it take in both kinds, as well *Turbinate* as *Bivalve*; yet it does more particularly denote a *Concha* or *Bivalve.*

3. The *Onyx* is expreſly reckon'd by *Pliny* amongſt the *Bivalves*. For (*l.* 32. *c.* 11.) he makes all theſe Synonimous, *Solen*, *ſive Aulos*, *ſive Donax*, *ſive Onyx*, *ſive Dactylus*. And again more particularly, (*lib.* 9. *c.* 61.) he ſays, *Concharum genere ſunt Dactyli, ab Humanorum Unguium ſimilitudine appellati.* So that in all probability the *Onyx Odoratus* brought more anciently out of the freſh-water Lakes about *Ganges* in *India,* was not unlike the common *Onyx* of the *Mediterranean,* which was of the *Solen* kind.

Whatever the *Blatta Byzantina* of our Shops is, which has certainly nothing of the Characters of the ancient Aromatick *Unguis*; and which in all probability was loſt upon the account of the difficult Paſſage from *Ganges* into *Europe*. I lament its Loſs, which I have reaſon to believe was a good Medicine, from its ſtrong Aromatick Smell; which is much wanting in our *Teſtaceous Powders*, of which this was one of the number, ſo much uſed, and that not without good reaſon now-a-days, which are all very flat and inſipid.

To the Third, The *Purpura* of the Ancients is well made out, and figured by *Fabius Columna*: And it is one of the moſt common *Murices* of the *Mediterranean* Sea. In this he could not be much miſtaken, becauſe, as I remember, he ſomewhere mentions heaps of thoſe Shells where the *Officinæ Purpuræ* anciently were; and alſo from the Purple *Sanies* the Fiſh yields of it ſelf. He mentions one or two more *Species* of *Turbinate* Snails, to be found in the *Mediterranean,* which yield a Purple Juice. Upon the whole matter it is indifferent, what ſort of Shell we uſe in the Shops, if it be to be calcined, provided it be a Sea-ſhell. Nor do I find either *Dioſcorides* or *Ætius* to have diſtinguiſh'd betwixt the *Oſtrea Purpura* or *Buccinum* calcined; but gives them all the ſame Cauſtick Virtue; poſſibly ſome one *Species* may have it in a higher degree, as we ſee the various ſorts of Lime-ſtone, if calcined, differ in ſtrength.

One thing I ſhall not omit before I end this Paper, becauſe it is now in my mind, that tho' the *Species* of Shell or *Purpura* be ſcarce known to our Shops at this day, yet the uſe of the Purple Juice has been by Tradition at leaſt tranſmitted down to our Times, and kept as a Secret even in theſe Iſlands, till Mr. *Cole* got hold of it, and publiſh'd it. Sir *Robert Southwell* the now Preſident of the *R. S.* told me many years ago, that his own Mother in *Ireland* was famous for marking Handkerchiefs with the Juice of Fiſh; which Mark would never waſh out. And the very Learned Mr. *John Beaumont* informs me of a paſſage in our *Beda*'s Eccleſiaſtical Hiſtory relating to the *Purple*, ~~as a~~ known thing in his time. The Paſſage is as follows:

Bedæ, Hiſtoria Eccleſiaſtica Gentis Angl. l. 1. c. 1.

Variis Conchyliorum generibus exceptis: in quibus ſunt & Muſculæ, *quibus incluſam ſæpè* Margaritam *omnis quidem coloris optimam inveniunt, id eſt,* & *rubicundi* & *purpurei,* & *hyacinthi* & *Praſini ſed maximè candidi. Sunt* & Cochleæ *ſatis ſuperque abundantes, quibus Tinctura coccinei coloris conficitur. Cujus rubor pulcherrimus nullo unquam ſolis ardore, nulla valet pluviarum injuria palleſcere; ſed quo vetuſtior, eo ſolet eſſe venuſtior.*

You ſee from this Paſſage the Purple Trade of Dying was uſed in *England*, and very much valued.

Of Mr. *Cole*'s you have a Cut in the *Philoſophical Tranſactions*, N°. 178.

Fig. 5. Repreſents the true *Purpura* of the Ancients by the *Italians* called *Geruſolo*.

IV. *An Extract of a Letter from Mr.* Anth. Van Leuwenhoek, *Concerning Animalcules found on the Teeth; of the Scaleyneſs of the Skin*, &c.

I Have often endeavoured to diſcover Animalcules in Spittle, but in vain: But examining a kind of gritty Matter from between my Teeth, and mixing it ſometimes with Rain-water, and ſometimes with Spittle, both which before had no Animalcules, I diſcovered therein with admiration a great number of very ſmall ones moving; the greateſt whereof are repreſented Fig. 2. *A.* they had a very ſtrong and ſwift Motion in the Water like Eeles, of theſe larger there were not many: A ſecond ſort is repreſented by *B.* theſe oft turned themſelves round like a Top, and moved ſometimes as is ſhewn by the Line *C. B.* theſe were much more in number. The Figure of the third ſort I could not well diſcover, ſometimes they appeared oval, and at other times round, they were ſo ſmall that I could not diſcern them greater than as at *E.* they moved ſwiftly by each other like Gnats playing in the Air, and of theſe I diſcerned Thouſands in a drop of Water they ſhewed no bigger than a Sand, and in the Drop, the Water was to the Animalcules as 9 to 1. But moſt of the Matter I examined, conſiſted of long ſlender parts all of a thickneſs, but differing in length as at *F.* and one crooked one amongſt the reſt; and becauſe I have formerly obſerved Animalcules of this ſhape in Water, I endeavoured to diſcover if theſe lived but could not. I have found the ſame in the Matter taken from between the Teeth of other Perſons, as well ſuch as drank Wine and ſmoaked Tobacco, as of ſuch as did neither,but not in their Spittle, in which I found no Animalcules. I found the ſame after I had waſhed my Teeth very well with Vinegar, tho the Vinegar kill'd them when they were put into it. Amongſt the reſt I ſaw ſome tranſparent Particles twenty five times bigger than a Blood-globule, which had they not ſunk down in the Liquor I ſhould have taken for Particles of Fat.

I examined the ſuppoſed Worms taken out of the Skin of the Noſe and other parts of the Face,but found them only ſoft brittle Particles of Fat: and perceiving on my Noſe ſeveral ſmall black Specks, I ſqueezed out ſome, and found them to be only a bundle of Hairs, and in one of theſe I told thirty ſix ſmall Hairs beſides the Matter that ſtuck about them. *Fig.* 3. *A B C D E*, repreſents one of theſe Hair bundles, as it ſhew'd in the Microſcope, *A B C* was that dark part which lookt like a black Speck in the Skin; every where elſe they were tranſparent. *E D* is the Roots of the Hairs, ſome longer, ſome ſhorter; theſe Hairs are eaſily rubb'd off the Skin, the Nouriſhment thereof being not ſufficient to maintain them any long time, or give them growth.

In a Letter to Mr. *Oldenburg*, in the Year, 1674. I mentioned that I could not otherwiſe perceive, but that the Scarf-inſenſible-skin conſiſted of ſmall round Scales and declared my Senſe of the Skins fabrick thus, That continually as it was worn away on the outſide, it was ſupplied from beneath, and in ſeveral Obſervations ſince I have found nothing new; for viewing them always by a common Microſcope they ſhewed as at *H*,*Fig*.4, which Scales I judged of that Minuteneſs, that a Sand might cover two hundred or more of them; but viewing them with a better Microſcope I find they are not formed by the moiſture tranſpiring through the Skin, as I then imagined; but that all the upper part of our Skin is ſcaley, if I may be allowed to uſe that word, for they are very like thoſe of Fiſh, tho' they are without Compariſon ſmaller, and ſerve to the ſame purpoſe, which is to defend the Skin; theſe Scales lay upon one another as thoſe of Fiſh: they were five-ſided, and I could plainly perceive a Border or Line about them, *K O P* repreſents a full grown Scale, *O P* the part joyned to the Skin; which was always narrower than the upper part; other Scales were not ſo long, nor even at the edges, being either worn or not full grown; they were as I gueſs'd about twenty five times broader than thick; they lay three double, for there was not about $\frac{1}{3}$ of each viſible; others lay as is repreſented *Fig.M.* the part 1, 2, 3, 4, being only viſible; this Scale was one of the moſt perfect, ſeveral of the reſt being not ſo ſharp pointed; the Scales of Fiſh lie after the ſame manner, only they never ſhed their Scales, and our Skin peels often; ſometimes a Thouſand Scales and more, together in a Flake. I took of ſome of the Scarf-skin from a ſmall Scar that remained from a Blood-letting twenty five Years ſince, and found thereon many ſuch Scales as is repreſented by *L*, upon many of theſe Scales appeared ſeveral irregular Lines, as in *Fig. M* is repreſented, in ſome places whereof were ſeen very ſmall Globules $\frac{1}{6}$ of a Blood-globule in ſize; as is likewiſe ſhewn. In this part, I believe a Flea thruſts his Sting into the Skin, between the two uppermoſt Scales.

By theſe Obſervations I have (now as well as formerly) ſhewn that there are no Pores in our upper Skin, but that the Moiſture thruſt out of our Body gets forth between the Scales, at which places there may be poſſibly Channels for it to iſſue at: if we conſider,

der, that two hundred of theſe Scales may be covered with a Sand, and that each Scale may have many Pores on the ſides, beſides the places where it is to be nouriſht: we may conclude the whole Skin to be but as one continued Pore.

I then examined ſome of thoſe Scales on the inſide of my Hand, where the Skin was thickeſt, and found that they differed from the other only in that they were thicker, and beſet with many Globules and Stripes; whereas the others on the Body are clearer; and whereas thoſe on the Body fall off, and peel for want of nouriſhment, thoſe on the inſide of the Hand by reaſon of a great quantity of a clammy Matter driven out thro' the Skin are faſtened to one another, ſo as to make a callous Subſtance. Labour and working likewiſe forcing out a greater quantity of this glutinous Matter.

V. *An Account of ſeveral Experiments made to examine the Nature of the Expanſion and Contraction of Fluids by Heat and Cold, in order to aſcertain the Diviſions of the* Thermometer, *and to make that Inſtrument, in all places, without adjuſting by a Standard. By Mr.* Edm. Halley, *S. R. S.*

Q*Ualities*, ſuch as Heat and Cold, Moiſture and Drineſs, and the like, are not otherwiſe to be eſtimated, but by their Effect on the *Quantity* of ſome body they act on, encreaſing or leſſening the Dimenſions thereof; or elſe by the Motions they produce, both which ſubject them to Menſuration; but it is ſtill a Queſtion how to aſcertain the proportional Heat or Cold, *&c.* that is between any two Climates or Seaſons, ſo as to conclude the one, for Example, twice as hot or twice as cold as the other, tho' the Inſtruments now in uſe abundantly ſuffice to ſhew when the Temper of the Air is the ſame, and when it is Warmer or Cooler. The Reaſon hereof is, that we know not the Cauſes of the Expanſion of *Fluids* by Heat, or of their Contraction by Cold, as ariſing from the Nature of their conſtituent parts, which are ſo far from being Objects of our Sence, that they even ſurpaſs our moſt refined Reaſonings, and extort a Confeſſion of our Ignorance after all our Endeavours. For the ſame degree of Heat does not proportionally expand all *Fluids*; ſome ſwelling with a gentle Warmth, and others not till they be conſiderably Hot; ſome boiling with a moderate Heat, and others not at all. Some capable of great Expanſion, others encreaſing very little; ſo that it may well be concluded that no one of them does encreaſe and diminiſh in the ſame proportion with the Heat, and conſequently that the *Thermometers* graduated by equal Parts of the Expanſion of any Fluid, are not ſufficient Standards of Heat or Cold.

This will be more evident from the Experiments which I made ſome time ſince, with Water, Mercury, and Spirit of Wine, wherein the following Particulars were very remarkable.

I. I took a large Bolt-Head, holding about $3\frac{1}{2}$ *l.* of Water, with a narrow Neck to make the Augment thereof more ſenſible; and having filled it with Water, and ſome few Inches up the Neck, I noted exactly to what Mark the Water came; then I immerſed it into a Skillet of warm Water, and let it ſtand ſo long, till I concluded the warm Water had communicated its Temper to the Water included in the Bolt Head. And I found that tho' the Water were warm, much beyond the degree of the Summers Heat, and notwithſtanding it was Winter; yet that gentle Heat had ſcarce any effect in dilating the Water, ſo that it ſcarce appeared to have aſcended in the Neck of the Bolt-head. Then I took the Skillet and ſet it over the Fire, when it was obſervable that the Water as it grew hot did ſlowly aſcend in the Neck, eſpecially at firſt; but after it began to boil in the Skillet, the Expanſion thereof became more viſible, and it aſcended apace till ſuch time as it ſtopped again, the utmoſt Effort of Boyling Water being able to raiſe it no higher: Then having made a Mark at the utmoſt height whereto it had ariſen, I took it out, and had the ſatisfaction to obſerve, that though it was not raiſed ſo high without a very ſtrong boiling, yet it ſubſided very ſlowly, as retaining ſome time the ſpace it had acquir'd from the Heat, even after the Heat was paſs'd, and the Glaſs was ſo cool as to be touched without burning the Fingers. However the next morning I found it reduced to the firſt Mark, where it ſtood when at firſt put in, ha-

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ving loſt nothing ſenſible by Evaporation during the Experiment, which I attribute to the length of the Neck wherein the Vapors were condenſed into Drops before they reached the Top. Then I examined how much Water would raiſe that in the Neck to the Mark whereto it had been encreaſed by boiling, and found it was a *twenty ſixth part* of the bulk of the firſt Water, which upon repeated Experiment I found to be true; but it was obvious that Water, encreaſing ſo very little with all the degrees of Heat the Air receives from the Sun, was a very improper Fluid to make a *Thermometer* withal; and beſides, any freezing Liquor is uſeleſs for this purpoſe in theſe Northern Climates.

II. I took a ſmaller Bolt-head with a proportional Cane or Neck, and filled it, after the ſame manner, with *Mercury*, and having boiled it as above, I obſerved that 125 Ounces of *Mercury* had encreaſed the ſpace of 810 Grains, or a *Seventy fourth part* of its bulk when Cold. But it was very remarkable, that whereas a gentle Heat had ſcarce any effect on Water, here on the contrary, the *Mercury* did ſenſibly aſcend at firſt, and had almoſt attained its greateſt Expanſion before the Water boiled in the Skillet. And after it boiled, though I let it ſtand very long over the Fire, I could not diſcern that the moſt vehement boiling had any effect on it, above what appeared when it firſt began to boil: The *Mercury* being taken out, as it cooled ſubſided, and in a few Hours returned to the Mark whereat it ſtood before it was put into the Water. This Fluid being ſo ſenſible of a gentle Warmth, and withal not ſubject to evaporate without a good degree of Fire, might moſt properly be applied to the Conſtruction of *Thermometers* were its Expanſion more conſiderable.

However ſmall as it is, it is ſufficient to diſturb the preciſe nicety of the *Mercurial Barometers*, ſhewing the counterpoiſe of the Preſſure of the Atmoſphere by a Cy-

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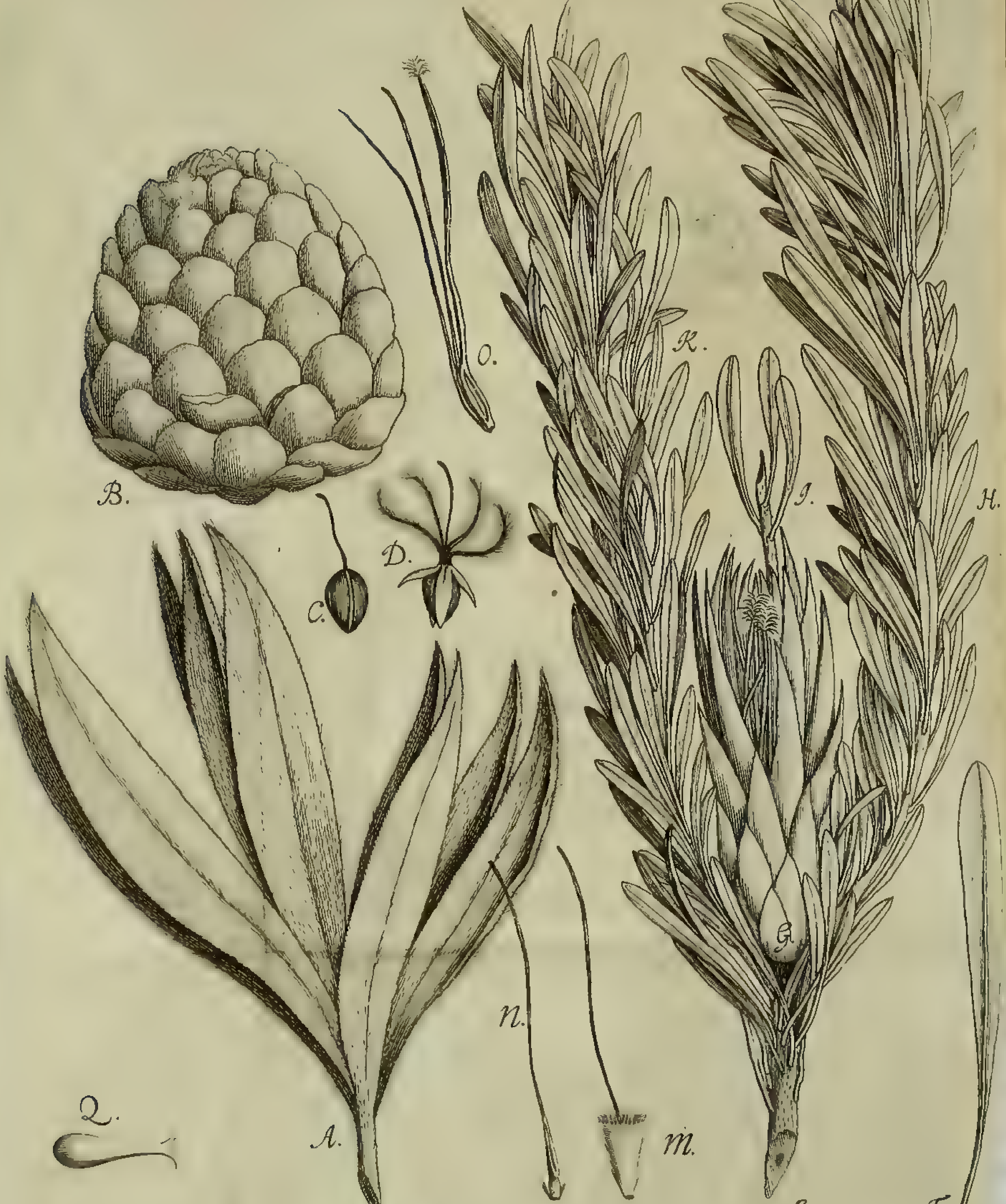
Philosophical Transactions N°.198.



linder of *Mercury*; for if *Mercury* be more expanded, and conſequently lighter in warm Weather than in cold, it will neceſſarily follow, that the ſame weight of Atmoſphere will require a taller Cylinder in Summer, and a ſhorter in Winter to counterpoiſe it. And if the Extremity of Weather do but occaſion an 150th part difference, as 'tis probable it doth, the effect thereof on a *Barometer* will be a tenth of an Inch above and below the Mean, or a Fifth in all.

III. I fill'd the ſmaller Bolt-head with Spirit of Wine, and having ſet it in the Skillet of Water over the Fire, I found that it aſcended gradually as the Heat encreaſed, but ſlower at firſt, and faſter after it was well warm. At length being arrived at a certain degree of Heat, it would fall a boiling with great Violence, emitting Bubbles, which coming into the Neck of the Bolt-head, would lift all the Incumbent Spirit, till they had made their way through. And theſe ſucceeding one another very faſt, would often raiſe the Spirit to the top of the Neck, and ſpill it; ſo that I found I could go no further with this Liquor, than to that degree of Heat which occaſion'd this boiling, and which wanted very much of that of boiling Water, being almoſt tolerable to the Touch. It was however very remarkable how exactly this degree of Heat was determin'd by the expanſion of the Spirit, for in the inſtant it reached a certain Mark on the Neck, it began to emit its Bubbles: and having been taken out a little to cool and ſubſide, it would certainly and conſtantly fall a bubling again, when upon a ſecond Immerſion, it was arrived at the aforeſaid Mark: During this Experiment, it appeared both by the Dew on the Neck, and by the Scent in the Room, that tho' the Neck were about 30 Inches long, yet the Spirit did evaporate very faſt for the ſmallneſs of the Surface of the Liquor And I have often noted the like Evaporations condenſed in

Dew within the Head of the ordinary ſeal'd *Thermometers*, in very hot Weather.

This degree of Heat which made Spirit of Wine begin to boil, being determined ſo nicely as I have ſaid, made me conclude, that this might very properly be taken for the Limit of the Scale of Heat in a *Thermometer*; and the effect thereof in the expanſion of any other Fluid being accurately noted, might be eaſily transferred to any ſort of *Thermometer* whatſoever. Only it muſt be obſerved, that the Spirit of Wine uſed to this purpoſe be highly rectified or dephlegmed, for otherwiſe the differing Goodneſs of the Spirit will occaſion it to boil ſooner or later, and thereby pervert the deſigned Exactneſs. And by the way give me leave to hint, that the ſooner or later boiling of Spirit or Spiritous Liquors may poſſibly be as good a Teſt of their Strength and Perfection as their Specific Gravity, or any other yet uſed.

The Spirit of Wine I made uſe of was poſſibly none of the beſt, but I obſerved that at the point of boiling it had encreaſed *a twelfth part* in bulk: Which great Dilatation makes it a Liquor ſufficiently adapted to our purpoſe, were it not for the evaporation thereof; and for the difference in goodneſs of the Spirit; and for that in length of time it becomes as it were effete, and loſes gradually a part of its expanſive Power, as I have been informed by thoſe who have long kept them.

All theſe Experiments were made in the Months of *February* and *March* about Four Years ſince, the Weather being reaſonably cold, and not freezing; and ſince I have not had the opportunity to try the effect of extreme Cold in contracting theſe Liquors, which muſt be refer'd till ſome ſharp Winter preſent us with a Seaſon proper for theſe Trials.

IV. Several other Liquors may be examined after this manner, but theſe alledged may ſuffice to ſhew the differing Effects of Heat upon differing Fluids; and that this Power of dilating and contracting with Heat and Cold is as ſpecifically in them as their Gravity, Refraction, &c. But in none is it comparably ſo conſpicuous as in that rare Elaſtick Fluid tbe Air; for by ſeveral Experiments that I have made, I find that the Heat of Summer does expand the ordinary Air about a *Thirtieth part*; and that late Honourable Patron of Experimental Philoſophy, Mr. *Boyle*, in his Hiſtory of Cold, *Tit.* 18. *Parag.* 8. *pag.* 475. alledges his own Trials, proving that the force of the ſtrongeſt Cold in *England* does not contract the Air above a *twentieth part*: So that the Sum of a twentieth and thirtieth part being a twelfth part, we may conclude that the ſame Air which is extream Cold occupies *twelve parts of ſpace*, in very hot Summer Weather will require *thirteen* ſuch Spaces; which is as great an Expanſion as that of Spirit of Wine when it begins to boil: For which reaſon, and for its being ſo very ſenſible of Warmth or Cold, and continuing to exert the ſame Elaſtick Power after never ſo long being included, in my Opinion it is much the moſt proper Fluid for the purpoſe of *Thermometers*.

Now the *Thermometers* hitherto in uſe are of Two ſorts; the one ſhewing the differing Temper of Heat and Cold by the Expanſion of Spirit of Wine, the other by the Air; but I cannot learn that any of them of either ſort were ever made or adjuſted, ſo as it might be concluded, what the Degrees or Diviſions of the ſaid Inſtruments did mean; neither were they ever otherwiſe graduated, but by Standards kept by each particular Workman, without any agreement or reference to one another: So that whatſoever Obſervations any curious Perſon may make by his *Thermometer*, to ſignifie the degree of Heat in the Air or other thing, (which is of conſtant Uſe in Philoſophical Matters) cannot be underſtood, unleſs by thoſe who have by them *Thermometers* of the ſame Make and Adjuſtment. Much leſs has the way been ſhewn how to make this Inſtrument without a Standard, or to make two of them to agree artificially without comparing them together.

I thought to have finiſhed this Diſcourſe with ſhewing a Method of conſtructing and regulating *Thermometers* to the beſt Advantage; but finding it neceſſary to make ſome Experiments with more Curioſity than I have yet done, eſpecially upon the Airs Expanſions. I crave leave, till one of the next Tranſactions, to inform my ſelf more fully in the matter, being unwilling to leave to the Trial of others, what perhaps I have better opportunity to examine my ſelf, eſpecially in what is moſt difficult in this nice Affair: I ſhall only propoſe, that whereas the uſual *Thermometers* with Spirit of Wine, do ſome of them begin their degrees from a Point, which is that whereat the Spirit ſtands when it is ſo cold as to freeze Oyl of Anniſeeds; and others from the Point of beginning to freeze Water: I conceive theſe Points are not ſo juſtly determinable, but with a conſiderable latitude: And that the juſt beginning of the Scales of Heat and Cold ſhould not be from ſuch a Point as freezes any thing, but rather from Temperature, ſuch as is in places deep under ground; where the Heat of the Summer, or Cold in Winter have (by the certain Experiment of the curious Mr. *Mariotte* in the *Grottoes* under the Obſervatory at *Paris*) been found to have no manner of effect. But of this more hereafter.

VI. An Account of a BOOK.

Novæ Hypotheſeos, *ad explicanda febrium intermittentium Symptomata & Typos excogitatæ* Hypotypoſis. *Unà cum Ætiologiâ Remediorum ; ſpeciatim vero de curatione per* Corticem Peruvianum. *Acceſſit Diſſertatiuncula de Inteſtinorum motu Periſtaltico. Authore* Guilielmo Cole, *M. D.* Lond. *in* 8°. 1693.

THE Learned Author declaring himſelf unſatisfied with the former *Hypotheſis* about the Production of *Intermitting Fevers*, but ſuppoſing, from the Conſideration of the Symptoms, that their Origine is owing to the *Nervoſum Genus*, has, agreeably to that Conjecture, formed to himſelf a new one ; by which, (having revolv'd it long in his Thoughts) he thinks he can give himſelf a clearer Account of the reaſon both of the Symptoms and Method of Cure, (particularly that by the *Cortex Peruvianus*) than from what others have laid down.

To clear his way to it, he firſt takes notice of Four *Hypotheſes* concerning them, which have either chiefly obtained, or, he thinks are the moſt conſiderable, *viz.* That of the *Ancients*, who deduce them from *Humours* putrifying *in primis viis* ; of *Sylvius*, who places his *Minera* in the *Pancreas* ; of Dr. *Willis* in the Maſs of Blood ; of Dr. *Jones* in the *Habit of the Body* : Of his Diſſent from each of which he alledges ſome Reaſons ; though in the general, (agreeably to three of them) that a *Ferment* to be ſomewhere reconded out of the Road of the circulating Blood, and there gradually maturated, is neceſſary to produce an interpolate Diſtemper.

In order to determine both the Matter and Form of this Ferment, he lays down ſome obvious Conditions of it; of which though ſome may agree to one, ſome to another of the enumerated Hypotheſes, yet he endeavours to ſhew, that All will not agree to any one of them, and therefore thinks ſuch a one is to be ſearched for, to which they eaſily will.

His own Opinion therefore is, That the *Cortical part of the Brain* may be the primary *Seat* of this Febrile Ferment; and that the Liquor to be there ſeparated, becoming diſproportionate to the Animal Functions, is the *Minera* of it; and, being thence diſpenſed into all parts of the *Syſtema Nervorum*, may by degrees riſe to ſuch a Maturation as may produce the Fits.

Here he takes occaſion to endeavour to eſtabliſh the Exiſtence of the *Nervous Juyce*, in confirmation of what he had heretofore delivered, and indeed (for a main Argument to evince it) to revive and farther make out, by a ſomewhat long Deduction, the Opinion of Dr. *Ent*, *Gliſſon*, *&c.* That we are not only directively, but *materially* nouriſhed by that Juice; for a particular Account of which we refer to the Author.

To this Notion of his, he endeavours to ſhew, that the alledged Conditions all agree; which done, he lays down his *Hypotheſis* of the manner of the Production of the *Paroxyſme* minutely; ſuppoſing, that ſome Incongruous, though at firſt inoffenſive, matter (on the ſcore of *Procatarctick* Cauſes he points at) being admitted into the Roots of the Nerves in the *Cortical* part of the *Brain*, is from them propelled into the *Medullary*, and thence into the Tracts of the *Nerves* and *Fibres* (which he takes to be but *Propagines Nervorum*) of the whole Body; in which moving ſlowly, it by degrees maturates into a *Fermentative Subſtance*, and acquires an Acrimony: With which when they are filled, and the Acrimony becomes troubleſome, they contract themſelves to expel it, it; but it being confined for ſome time (for Reaſons alledged) does neceſſarily put them upon repeated Contractions (in which he places the Nature of the *Rigor*) till they at laſt expel it into the Maſs of Blood, amongſt whoſe very *Heterogeneous* Particles (many of which too, are *Sulphurous*) it makes a great Commotion; which cannot ceaſe till both the Particles of this Ferment, and the diſturbed Ones of the Blood, are ſubdued and reduced into order, or expelled. But this *Atony* of the Glandules of the Brain continuing, nay in ſome meaſure increaſed by the Diſeaſe, the fore-mentioned Admiſſion of more *Heterogeneous* Matter muſt be repeated, as, in the ſame order, the Maturation, Eruption into act, and Extraſion of it, with the alledged Conſequents; and that ſo often till either by Medicines, or the change of Seaſon, or other Cauſes, theſe Glandules come to recover their Priſtine *Force*.

This *Hypotheſis* he endeavours to confirm from ſome obvious general Conſiderations, and then proceeds firſt to enumerate, in their order of Invaſion, the *Symptoms* which moſt uſually offer themſelves, and then to ſolve them from his *Hypotheſis*.

This done, he conſiders the *Types*; which not having been accounted for to his Satisfaction by former Authors, he takes himſelf to be obliged to try whether they can be from his *Hypotheſis*, and therefore offers a new one about them to conſideration.

Therefore in the firſt place he conſiders that the three ſorts of regular and uſual *Types*, *Quotidian*, *Tertian*, and *Quartan*, do generally obſerve certain determinate Seaſons of the Year, and not frequently happen at others, *viz.* *Quotidians* in the *Winter*, *Tertians* in the *Spring*, and *Quartans* in the *Autumn*; but that rarely *Intermittents* begin in the Summer. In the ſeveral Conſtitutions of theſe Seaſons he ſuppoſes our Blood and other Juices obtain likewiſe different Conſtitutions, which he

explains

explains ; ſo that there muſt, in general, be a difference in the circumſtances of Diſeaſes, though of the ſame Denomination, which happen in either of them. But to ſign a reaſon why we have *Periodical* returns,he conſiders, *Firſt*, That we generally *Eat* at determinate Times, from whence the admiſſion, as well as diſtribution of the *Nutritious* Juice (which he before ſuppoſed to be by the *Nerves*) muſt be *Periodical.* But this being not ſufficient, ſince moſt perſons eat oftner than once a day, he conſiders, *Secondly*, That we ſleep ordinarily but once in 24 Hours, at which time the *Brain* being relaxed, admits the Suppliments of Nouriſhment for the next day, as upon waking it begins, and all day after continues gently to protrude it (at leaſt more vigorouſly) through the whole *Fibrous Syſteme* ; in which time it advances in it's Maturation, as uſually toward becoming a fit *Nutritious* Juyce, ſo now, being in ſome degree incongruous, toward a *Febrifick* Ferment; ſo that, *cæteris paribus*, a *Diary* Period (unleſs when a greater, or more depraved, quantity than uſual of *Heterogeneous* matter abounds) may be hence expected. But to determine the reaſon of longer *Periods*, he ſuppoſes, *Thirdly*, We muſt have recourſe to the different Conſtitutions of the year : And in the *Spring* the Air abounding (by general conſent) with *Nitrous* Particles, which though active, and thence apt to exagitate and exalt a Morbifick Ferment, yet helping to conſtitute the Principles of *Vitality*, and in ſome degree corroborative of the *Tone* of the *Glandules*, they hinder, in ſome meaſure, the encreaſe of the Morbid matter in them, ſo that ſo much cannot be congeſted in the *Syſteme* of the *Nerves* and *Fibres* as to riſe to a degree of Vellication able to produce a *Paroxyſme* ; whence there is a neceſſity of a *ſecond Night's ſupplies* to yield a proportionable quantity to the effect. But in the *Autumn*, *Acids* abounding, which both in ſome degree repreſs Fermentation, and withal help to conſtringe the Tone of the parts, the Congeſtion cannot be made ſo ſuddenly as in other Seaſons; and therefore, ſince the admiſſion of the matter is had in Sleep, enough cannot be taken in under a *ſecond Night's Interval* to ſupply enough for a Turgeſcence; which the nature of the matter in ſome meaſure hinders from riſing up to it.

The *longer* Periods he ſuppoſes are deducible from a greater diſpoſition to Acidity in the *Nervous* Juice. And that the Seat of the Diſtemper is there, the Conſideration of the *Symptoms*, wholly or chiefly affecting the *Nervoſum Genus* in thoſe longer Periods, ſo far as he has obſerved, ſeem to him a cogent Argument.

As to the *Anomalies* of them, he ſuppoſes them, in the *Fourth* place, deducible partly from the *Variety* of the Conſtitutions of *Particular Perſons*, partly from particular *Changes* of the *Air*, *Aliments*, &c. and from *external occaſions*, which cannot be enumerated.

Then he comes to conſider the *Method of Cure*: And ſince ſeveral Adminiſtrations are neceſſary (ſome at one time of the Diſtemper, ſome at another; and ſome for ſome Perſons, ſome for others, according to various Circumſtances) he goes through them, and endeavours to render an Account in general, on what Score *Plebotomy*, *Vomits*, *Purgers*, *Diaphoreticks*, *Diureticks*, *Altering Medicines*, as *Digeſtives*, *Specificks*, *Opiats*, and *Pericarpia* produce their effects, when 'tis proper in their turns to uſe them. After which he delivers a ſufficient account of the particular Methods which he conceives proper for each of the three ſorts of intermitting Fevers.

But ſince the *Cortex Peruvianus* is become ſo Celebrated, as well as it is an effectual Remedy for them all, he in an entire Chapter offers an Ætiology of it, agreeably to the Hypotheſis he has laid down of their Source, and from Mechanical Principles. To form which, he, 1*ſt*, enumerates ſeveral *Obſervables* relating to its known effects and circumſtances of its Exhibition. 2*ly*. He conſiders the *Texture* of it, which he takes to be very compact, and not quickly diſſoluble by the Ferments 'tis now to meet with. *3ly.* He enquires into the *Scene* of its Operation, where he traces it through the *ways of the Chyle*, thoſe of the *Blood*, the *Habit* of the Body, and the *Syſtema Nervorum*, and thinking (for the Reaſons he alledges) 'tis not to be found, adequately to the effect, in the three former, he places it in the laſt, and endeavours to make it out from ſeveral Deductions. *4ly.* He deſcribes in a Mechanical way the *manner of its* Action; ſuppoſing that ſome of its Particles having undergone ſeveral Comminutions (tho not a Diſſolution) from the various Firments they have paſſed, arrive at laſt, with the Blood, at the Brain; and being, with ſome of its Vehicle, ſeparated there from the groſſer parts of both, in the Cortical Glandules, they are admitted into the tubulated Roots of the Nerveous Tree, by the way that the Nutritious Jayce is ſupplied; into which thoſe of them, which are not ſmall enough to paſs thoſe *S*traits along with the Juice, being juſt admitted, ſtick there till other appelling *S*ubſtances give them a farther Comminution, and ſo pretrude them along: But on the ſcore of their irregular ſides he ſuppoſes they leave room (indeed) between them and the ſides of thoſe round Veſſels for the finer Juice to paſs, but preclude the entrance to the groſſer (which he has ſuppoſed, is the matter that makes the Febrile Ferment) and thereby prove no way injurious to the Animal Functions, ſince enough, and that the pureſt, may paſs by them to actuate the Nerves. Whilſt theſe Particles ſtick here, he conceives that by ſoftly cancinating the including Coats with their Angles, they may cauſe them to contract themſelves to their due Tone, and they crumbling by degrees as that is doing, leave the part in its natural Eſtate, and ſo (without a freſh Cauſe) the Diſtemper ceaſes. *5ly.* He endeavours to ſhew, that all the mentioned *Obſervables agree* to his Hypotheſis. *Laſtly,* To accomodate theſe Speculations to Practice, he lays down briefly the Method to be obſerved in relation to the giving it; thinking withal, it may be uſeful in moſt Chronical Periodical Diſtempers; and concludes with a couple of Hiſtories, to confirm his Notion of the *S*eat of the Diſtemper, and the *S*cene of the Operation of the Cortex.

His ſubjoined Diſcourſe concerning the *S*piral Fibres of the Inteſtines having been many years ſince publiſhed in *Engliſh* in the Philoſophical Tranſactions, he now, at the importunity of ſome Friends, has thought fit to publiſh in *Latine.*

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Numb. 198

PHILOSOPHICAL TRANSACTIONS.

For the Month of March, 1693.

The CONTENTS.

I. *Some farther Conſiderations on the* Breſlaw *Bills of Mortality, by the ſame Hand with the former.* 196. II. *What a Compleat* Treatiſe *of* Navigation *ſhould contain: Drawn up in the Year* 1685. *by Sir* William Petty, *late Fellow of the* R. Soc. III. *A Letter from Sir* Robert Redding, *late* S. R. S. *concerning Pearl-Fiſhing in the North of* Ireland, *communicated by Dr.* Liſter, R. S. S. IV. *An Account of two Plants lately brought from the Cape of* Good Hope, *communicated by Dr.* Hans Sloan, *R. S. S.* V. *The Extracts of Four Letters from Mr.* John Baniſter *to Dr.* Liſter, *R. S. S.* VI. *An Account of the digging and preparing the* Lapis Calaminaris, *in a Letter from Mr.* Giles Pooley *to Sir* Robert Southwell, *Preſ. R. S.* VII. *An* Arithmetical Paradox *concerning the Chances of* Lotteries: *By the Honourable* Francis Roberts, *Eſq; S. R. S.* VIII. *An Account of Books.* 1. Horti Indici Malabarici. Pars Quarta, Quinta & Sexta. *With ſome Remarks upon them. By* Tancred Robinſon, *M. D. S. R. S.* 2. *A Treatiſe of the* Roman *Ports and Forts in* Kent, *by* William Somner, &c. Oxon. *in* 8°. 1693.

I. *Some further Conſiderations on the* Breſlaw *Bills of Mortality. By the ſame Hand*, &c.

SIR,

WHat I gave you in my former Diſcourſe on theſe Bills, was chiefly deſigned for the Computation of the Values of Annuities on Lives, wherein I believe I have performed what the ſhort Period of my Obſervations would permit, in relation to exactneſs, but at the ſame time do earneſtly deſire, that their Learned Author Dr. *Newman* of *Breſlaw* would pleaſe to continue them after the ſame manner for yet ſome years further, that ſo the caſual Irregularities and apparent Diſcordance in the Table, *p.* 599. may by a certain number of Chances be rectified and aſcertain'd.

Were this *Calculus* founded on the Experience of a very great number of Years, it would be very well worth the while to think of Methods for facilitating the Computation of the Value of two, three, or more Lives; which as propoſed in my former, ſeems (as I am inform'd) a Work of too much Difficulty for the ordinary Arithmetician to undertake. I have ſought, if it were poſſible, to find a Theorem that might be more conciſe than the Rules there laid down, but in vain; for all that can be done to expedite it, is by Tables of Logarithms ready computed, to exhibit the *Rationes* of *N* to *Y* in each ſingle Life, for every third, fourth or fifth Year of Age, as occaſion ſhall require; and theſe Logarithms being added to the Logarithms of the preſent Value of Money payable after ſo many Years, will give a Series of Numbers, the Sum of which will ſhew the Value of the Annuity ſought. However for each Number of this Series two Logarithms for a ſingle Life, three for two Lives, and four for three Lives, muſt neceſſarily be added together. If you think the matter, under the uncertainties I have mentioned, to deſerve it, I ſhall ſhortly give you ſuch a Table of Logarithms as I ſpeak of, and an Example or two of the uſe thereof: But by Vulgar Arithmetick the labour of theſe Numbers were immenſe; and nothing will more recommend the uſeful Invention of Logarithms to all Lovers of Numbers, than the advantage of Diſpatch in this and ſuch like Computations.

Beſides the uſes mentioned in my former, it may perhaps not be an unacceptable thing to infer from the ſame Tables, how unjuſtly we repine at the ſhortneſs of our Lives, and think our ſelves wronged if we attain not Old Age; whereas it appears hereby, that the one half of thoſe that are born are dead in Seventeen years time, 1238 being in that time reduced to 616. So that inſtead of murmuring at what we call an untimely Death, we ought with Patience and unconcern to ſubmit to that Diſſolution which is the neceſſary Condition of our periſhable Materials, and of our nice and frail Structure and Compoſition: And to account it as a Bleſſing that we have ſurvived, perhaps by many Years, that Period of Life, whereat the one half of the whole Race of Mankind does not arrive.

A ſecond Obſervation I make upon the ſaid Table, is that the Growth and Encreaſe of Mankind is not ſo much ſtinted by any thing in the Nature of the *Species*, as it is from the cautious difficulty moſt People make to adventure on the ſtate of *Marriage*, from the proſpect of the Trouble and Charge of providing for a Family. Nor are the poorer ſort of People herein to be blamed, ſince their difficulty of ſubſiſting is occaſion'd by the unequal Diſtribution of Poſſeſſions, all being neceſſarily fed from the Earth, of which yet ſo few are Maſters. So that beſides themſelves and Families, they are yet to work for thoſe who own the Ground that feeds them: And of ſuch does by very much the greater part of Mankind conſiſt; otherwiſe it is plain, that there might well be four times as many Births as we now find. For by computation from the Table, I find that there are nearly 15000 Perſons above 16 and under 45, of which at leaſt 7000 are Women capable to bear Children. Of theſe notwithſtanding there are but 1238 born yearly, which is but little more than a ſixth part: So that about one in ſix of theſe Women do breed yearly; whereas were they all married, it would not appear ſtrange or unlikely, that four of ſix ſhould bring a Child every year. The Political Conſequences hereof I ſhall not inſiſt on, only the Strength and Glory of a King being in the multitude of his Subjects, I ſhall only hint, that above all things, Celibacy ought to be diſcouraged, as, by extraordinary Taxing and Military Service: And thoſe who have numerous Families of Children to be countenanced and encouraged by ſuch Laws as the *Jus trium Liberorum* among the *Romans*. But eſpecially, by an effectual Care to provide for the Subſiſtence of the Poor, by finding them Employments, whereby they may earn their Bread, without being chargeable to the Publick.

II. *What a Compleat* Treatiſe *of* Navigation *ſhould contain. Drawn up in the Year* 1685. *by Sir* William Petty *late Fellow of the Royal Society.*

1. WHat *Arithmetick* in whole Numbers and Fractions, as alſo in *Decimals* and *Logarithmes*, is neceſſary for the ſame? And what *Books* are beſt for teaching ſo much thereof?

2. What *Vulgar Practical Mechanical Geometry* performable by the Scale and Compaſs is ſufficient?

3. What *Trigonometry*, Right Lined, and Spherical will ſuffice?

4. How many Stars are to be known?

5. What *Inſtruments* are beſt for uſe at Sea, with the Conſtruction of them, and the manner of uſing them?

6. The whole Skill of the *Magnet*, as to the directive Vertues thereof, and all the Accidents which may befall it.

7. The *Hydrography* of the Globe of the Earth, the Perſpective of the Coaſts, and the Deſcription of the under-water-bottom of the Sea.

8. The knowledge of *Winds* and *Meteors*, ſo far as the ſame is attainable.

9. The Hiſtory and Skill of all ſorts of *Fiſhings*.

10. The Art of *Medicine* and *Chyrurgery*, peculiarly for the Sea.

11. The Common Laws of the *Admiralty*, and *Juriſdiction* of the Sea.

12. The ſeveral *Victuallings* and *Cloathings*, fit for Sea-men.

13. The whole Science of *Ebbing* and *Flowing*, as alſo of *Currents* and *Eddyes* at Sea.

14. *Dromometry*, and the Meaſures of a Ships Motions at Sea.

15. The *Building* of *Ships* of all ſorts, with the ſeveral *Rigging* and *Sails* for each *Species*, and the *Uſe* of all the *Parts* and *Motions* of a *Ship*.

16. Naval *Oeconomy* according to ſeveral Voyages and Countries.

17. The *Art* of *Conting*, *Rowing* and *Sailing* of all the ſeveral ſorts of *Veſſels*.

18. The *Gunnery*, *Fire-works* and other *Armatures* peculiar to Sea and Sea-Fights.

19. The Art of *Loading* and *Unloading* the Chief Commodities, to the beſt Advantage.

20. The Art of *Weighing* ſunken Ships and Goods, as alſo of *diving* for ſunken Goods in deep Water.

21. The General *Philoſophy* of the *Motion* and *Figures* of the *Air*, the *Sea*, and of *Seaſons* ; of *Timber*, *Iron*, *Hemp*, *Tar*, *Brimſtone*, *Tallow*, &c. and of their ſeveral Uſes in Naval Affairs.

22. An Account of Five or Six of the beſt *Navies* of *Europe*, with that of the *Arcenals*, *Magazines*, *Docks*, *Yards*, *&c.*

23. An Account of all the *Shipping* able to croſs the Seas belonging to each Kingdom and State of *Europe*.

24. An Account of all the chief *Commercial parts* of the *World* ; with mention of what Commodities are originally carried from, and ultimately to any of them.

25. An Account of the Chief *Sea-Fights*, and all other *Naval Expeditions* and *Exploits*, relating to *War*, *Trade* or *Diſcovery*, which hath happened in this laſt Century.

26. Of the moſt advantageous uſe of *Teleſcopes* for ſeveral purpoſes at Sea.

27. Of the ſeveral *Depths* of the Sea, and Heights of the *Atmoſphere*.

28. The Art of making *Sea-Water freſh* and potable, and fit for all uſes in Food and Phyſick at Sea.

III. *A Letter from Sir* Robert Redding, *late Fellow of the R. S. concerning Pearl-Fiſhing in the North of* Ireland; *communicated to the Publiſher by Dr.* Liſter. *R. S. S.*

Dear SIR,

BEing in the North in *Auguſt* laſt, and calling to remembrance your Deſires to have ſome of the Muſcle-ſhells ſent you wherein the Pearls were found, I ſtayed behind my Company one day like an old Hound from following the Stag, and beſtowed it in Enquiries from others, and ſome ſmall Trials in the Rivers; but having by me neither Queries to direct my Search, nor Books to inform me what had been delivered by others on this Subject, I muſt needs fall ſhort in thoſe Points that are moſt curious and moſt wanting, and take notice only of what is too common and moſt known in the Natural Hiſtory of this Shell-fiſh.

I have ſent you four or five of the Shells, and a few of the Pearls, though clouded and little worth, taken out of the River near *Omagh* in the County of *Tyrone*, in which County are four Rivers abounding with theſe Muſcles, all emptying themſelves into *Lough foyle*, whereon ſtands the Town of *Derry*, and ſo into the Sea. There are alſo other Rivers in the County of *Donegall*, a River near *Dundalk*, the *Shure* running by *Waterford*, the *Lough* called *Lough-Lean* in *Kerry*, which afford the like Fiſh; and no doubt there be many more that I do

not

not know: All theſe places are at the feet of very great Mountains.

The manner of their Fiſhing is not extraordinary, the poor People in the warm Months before Harveſt is ripe, whilſt the Rivers are low and clear, go into the Water, ſome with their Toes, ſome with wooden Tongs, and ſome by putting a ſharpned Stick into the opening of the Shell take them up: And although by common Eſtimate not above one Shell in a Hundred may have a Pearl, and of thoſe Pearls not above one in a Hundred be tolerably clear, yet a vaſt number of fair Merchantable Pearls, and too good for the Apothecary, are offered to Sale by thoſe People every Summer Aſſize. Some Gentlemen of the Country make good Advantage thereof, and my ſelf whilſt there, ſaw one Pearl bought for 50 Shillings that weighed 36 Carrats, and was valued at 40 *l.* and had it been as clear as ſome others produced therewith, would certainly have been very valuable. Every body abounds with ſtories of the good Pennyworths of the Country, but I will add but one more: A Miller took out a Pearl which he ſold for 4 *l.* 10 *s.* to a Man that ſold it for 10 *l.* who ſold it to the late Lady *Glenanly* for 30 *l.* with whom I ſaw it in a Necklace; ſhe refuſed 80 *l.* for it from the late Dutcheſs of *Ormond.* I was informed that in the courſe of the River of about Sixteen Miles, there were many deep Pools, which could never have been ſearched by theſe unmechanical People, for whom I made a Dredge with ſome Teeth in the Knife of it to rake them out of the Sand, and in that only particular differing from the common Oyſter Dredge; as alſo little Hand-dredges, not unlike what I had ſeen Men in the River of *Thames* taking up Ballaſt with.

I took up many young Muſcles, but theſe have never any Pearl in them, and do think to get ſome Pond or ſmall Brook by the Rivers ſide to preſerve them in, rather than to deſtroy them unprofitably.

The Natives, though very foul Feeders, will not eat the Fiſh, which ſeems to me to cut like the Oyſter, blackiſh green; and were it not too great a Digreſſion from the Subject, and too offenſive to good Stomachs, I could entertain you with their laſt *Lenten* Fare, when Horſe-fleſh dead of Diſeaſes, and the Blubber of a Whale caſt up by chance, (when it would fly upon the opening of the Bung-hole of the Barrel like Bottle Beer) was ſought for, and begged for Food, ſo lazy and improvident many of them are. The Shell is faſtned with two Cartilages, one at each end, whereas the Oyſter and Scallop are with one only in the middle. The natural Poſture they keep to, neither lying on the ſide, as thoſe I ſaw, or ſet up in the Sand like Eggs in Salt, with the ſharp end downwards, and the opening ſide turned from the Torrent, as the People ſay, I leave to be further enquired into; but I ſaw them lying in part opened, and putting forth their White Fins like a Tongue out of the Mouth, which directs the Eye to them in the Water, being otherwiſe black as the ſtones in the River.

The backs of the Shells juſt about the Hinges on which the Valves do open are all broken and bruiſed both young and old, and ſhew the ſeveral Cruſts and Scales that make the Shell, and is cauſed (I think till I know better) by the many great ſtones that are driven over them by the Floods which are moſt impetuous after any little Rain.

You will obſerve the in-ſides of the ſhells are of an Oriental and Pearly Colour and ſubſtance like a flat Pearl, eſpecially when firſt opened; and I was told by an ingenious Perſon living upon the place, that he had obſerved in ſome ſhells under the firſt Coat a Liquor that was very orient and clear, that would move upon the Preſſure of the Finger, but that ſuch a Muſcle never had Pearl, which Liquor I ſhould think was the true Mother of Pearl.

The part where the Pearl lieth is in the Toe or leſſer end, at the extremity of the Gut, and out of the body of the Fiſh between the two Films or Skins that line the ſhell: I was careful to leave one Pearl in its Bed; but the Fiſh ſtinks ſo extremely and ſo ſoon, and ſhrunk into nothing, that I fear it will be hard to preſerve the parts entire for the Inſpection.

I believe that this Pearl anſwereth to the Stone in other Animals, and certainly like that encreaſeth by ſeveral Cruſts growing over one another, which appeareth by pinching the Pearl in a Vice, and the upper Coat will crack and leap away; and this Stone is caſt off by the Muſcle, and voided as it is able; and many ſhells that have had Pearls in them are found now to have none, which will appear by theſe inſtances. The ſhells that have the beſt Pearls are wrinkled, twiſted or bunched, and not ſmooth and equal as thoſe that have none, as you may obſerve by one of the Shells herewith ſent, of a lighter Colour than the reſt; this ſhell yielded a Pearl ſold for 12 *l.* And the crafty Fellows will gueſs ſo well by the ſhell, that though you watch them never ſo carefully, they will open ſuch ſhells under the Water, and put the Pearls in their Mouths, or otherwiſe conceal them. That ſame perſon told me, that when they have been taking up ſhells, and believed by ſuch ſigns as I have mentioned, that they were ſure of good purchaſe, and refuſed good Sums for their ſhares, that yet they found no Pearl at all in many of them. Upon Diſcourſe with an old Man that had been long at this Trade, he adviſed me to ſeek not only when the Waters were low, but in a dusky gloomy day alſo, Leſt, ſaid he, the Fiſh ſee you, for then he will ſhed his Pearl in the ſand: Of which I believed no more, than that ſome Muſcles had voided their Pearls, and ſuch are often found in the Sands.

I conceive that theſe Pearls if once dark will never be clear upon any alteration in the Health or Age of the Muſcle, or of the Moon; and that if the firſt Seed be black, all the Coats ſuperinduced will be ſtill clouded; but yet would be glad to be directed in any further Enquiry of any amendment that may be made by the Seaſon of the Year, Age of the Moon or Fiſh, or place in the Rivers, the bottoms whereof I obſerved to be part ſandy, part ſtony, and part ouſey, and of a black Clay.

It may be alſo conſidered, whether brackiſh Water will alter the Colour; for many Muſcles are driven down the Rivers Four or Five Miles within the flowing of the Tide, namely, to a place called the *Gribbin*, where the greateſt Salmon-fiſhing is next to that of *Colerain*.

You will obſerve the ſame Pearl clear at one end, and dark at the other; it may be enquired whether the Colour ever changed from one to the other, or was primigenial, as they ſtill continue. I ſhall deſire your kindneſs in ſending me ſome Heads of Enquiries, for I have many Acquaintance upon the place, with Directions how I may preſerve the Muſcle to ſend you, and whether ſuch dark Pearl may not be as proper for the Apothecary as other more clear, and what better Engines you can direct us unto to take them up with, no place being deeper than 12 Feet.

I ſend you alſo herewith ſome Stones of an Amber Colour taken out of a Spring called *Cranbourn-Spring* near *Lough-Neah*, which the Country-People tell us grow at the end of a little Ruſh, and drop off, and are to be found only on *May* day Eve, and good for God knows what: They look like the Germinations of ſome of your Salts, but in the Fire ſhewed no ſigns thereof by crackling; they are Electrical and Angular, and being pounded, the Powder is white. I have ſeveral Stones and Minerals by me, which if I knew were acceptable to you, ſhould be ſent forwards; but I would gladly firſt be aſſured you are not diſpleaſed with theſe Trifles from

Yours, &c.

Dublin, Oct. 13.
1688.

IV. *An Account of two Plants lately brought from the Cape of* Good-hope, *communicated by Dr.* Sloane, *R.S.S.*

ALderman *Charles Chamberlain* having favoured the Royal Society to preſent them (among other natural Rarities) with two Branches of Trees and their Fruits, brought from the *Cape of Good-hope* by Mr. *Goddard*, which being very curious, and are not yet any where perfectly deſcribed, it was thought fit to publiſh their Figures and Deſcriptions; and that the rather, becauſe the firſt of them has been brought hither for its Beauty in Pots, as well as raiſed in *England* from the Seed brought from the *Cape of Good-hope*, where it is called the *Silver Pine*.

Conifera ſalicis facie, folio & fructu, tomento ſericeo, candicante, obductis, ſemine pennato.

The

The Silver Pine-Tree.

THE Twig of this Tree (ſee the *Fig. Lit. A*) had a great many Leaves ſet round it very cloſe to one another, ſo as to hide the Twig its ſelf there where they grow, each of the largeſt of them being about Four Inches long, and ¾ of an Inch broad in the middle where broadeſt, from whence they decreaſe towards both Extreams ending in a Point, being like thoſe of the Oſier Willow, only broader, and all cover'd over with the thickeſt, fineſt, and longeſt white ſilken Hair or Down that ever any Plant I remember to have ſeen has. The Cones (ſee the *Fig. lit. B*) are of the bigneſs of thoſe of the Cedars of *Lebanon*, and of the ſame ſhape the *Cuticula* or ſmall Skin of each Scale, being cover'd over with a white ſhort Down or Wool, ſhining alſo like Silk. Between the Scales is lodged the Seed, (ſee the *Fig. lit. C*) which is almoſt as large as the Pine-Nut, near the ſame ſhape, of a dark brown Colour, and having a riſing eminent Line or Belly running through the middle of it from end to end. This Seed lies in a thin reddiſh brown Membrane, which has on its top Four Feathers like thoſe belonging to the Seeds of *Clematis*, which being between the Scales, and riſing above them, adds a very great Beauty to the Cone, and may likewiſe ſerve for Wings by means of the Wind to looſen or carry the Seeds to diſtant places, thereby propagating its ſelf. The Seed with its Membrane and Wings is well expreſſed in the *Fig. lit. D.*

This grows at the *Cape of Good-hope*, where I am aſſured by Mr. *James Pettiver*, that it is planted by the *Dutch* in their Famous Garden, being thought one of its greateſt Ornaments.

The firſt Author I have obſerved that ſeems to mention this is Captain *Nicholas Dounton*, who ſpeaking of things he obſerved by the *Cape of Good-hope apud Purchas, lib.* 3. *cap.* 12. § 1. *p.* 276. ſays, ‘ In divers places ‘ ſcatteringly we ſaw ſome Trees of ſmall Stature, ſome- ‘ what broad topped, bearing a Fruit in bigneſs and pro- ‘ portion like a Pine-Apple, but the Husk not ſo hard ‘ and ſpungie, the Seed whereof were devoured by ‘ the Birds, the Husks remaining on the Trees, the ‘ Leaves whereof were in form of our Houſleek in *Eng- ‘ land*, but not ſo thick.

Mr. *Breynius* likewiſe in his firſt Century of Exotick Plants, *pag.* 22. mentions a larger ſort of *Frutex Æthiopicus Conifer foliis cneori, ſalici æmulus*, which perhaps may be this.

Dr. *Plucknet* in the Third Part of his *Phytographia, Tab.* 200. has figured this under the name of *Leucadendros Africana Arbor tota Argentea, ſericea foliis integris, Atlas Tree D. Herman*, which was the top of one of theſe Young Trees which came to Mr. *Doody*.

2. *Conifera Alypi folio, ſeminibus pennatis pluribus in medio coni conglomeratis, & non inter ſquammas aliorum conorum more naſcentibus* !

The Branch of this Tree (ſee the *Fig. lit. E*) had a brown coloured ſmooth Bark with a whitiſh hard Wood, and ſmall pith. The Leaves (expreſſed to their natural Bigneſs *lit. F*) were round it without any Order, very thick ſet, having no Foot-ſtalks, being about 2 inches and ½ long, and about ⅓ of an inch broad near the farther end where broadeſt, ſmooth, hard, and of a browniſh or dirty green colour; on the top of the Branch comes the Fruit, (ſee the *Fig. lit. G*) which is ſurrounded by three or four Twigs (ſee the *Fig. lit. H, I, K*) overtopping it, and with their Leaves almoſt hiding it. It is about Five Inches long, and is made up of many Scales hard and red encloſing one another, the lowermoſt and outwardmoſt being very ſhort, the inwardmoſt Four Inches long, each of them ending in a Point, ſome Scales having on their out-ſides a gummy Juice. In the middle of theſe Scales were the firſt Rudiments of many Seeds, the ſame not being fully ripe, each of which (ſee the *Fig. lit. L*) is ſet about with a great quantity of ¼ inch long, yellow fine ſilken Down, (ſee the *Fig. lit. M*) having a two Inches long *Stylus* or String, (ſee the *Fig. lit. N*) and yellowiſh Membranes encloſing the *Stylus* and *Tomentum*, being feathered at top with Feathers for the ſame purpoſes, and like the former.

I cannot find this mentioned by any Author, unleſs it be that of *Breynius* in his Appendix to his firſt Century, *p.* 22. *Frutex Africanus, fruticis terribilis Narbonenſium folio capitulis oblongis ſquammoſis*, gathered by *Wilhelmus Ten Rhine*, and ſent to him from the *Cape of Good-hope*.

V. *The Extracts of Four Letters from Mr.* John Baniſter *to Dr.* Liſter, *communicated by him to the Publiſher.*

S I R,

TO do right to the Memory of my Friend Mr. *Baniſter*, who indeed was a very Learned and Sagacious Naturaliſt; had lived 14 years at leaſt in *Virginia*, and therefore, having employed much of his Time that way, was moſt likely to have given us a very good Natural Hiſtory of that place. I underſtand after his Death the Government of that place took ſpecial care of his Papers to ſeal them up, and tranſmit them to my Lord Biſhop of *London* here, in whoſe Hands they are, and therefore I doubt not but they will be carefully and ſpeedily publiſh'd, unleſs poſſibly, it may not be thought as proper, being poſthumous and incoherent Pieces, to have them printed in your Tranſactions, which is a ſaving Regiſter of many good things, which elſe would be in danger to be loſt; beſides the advantages of Deſign, which here will coſt the Author nothing, and which is the great Trouble in the Publication of things relating to Natural Hiſtory; you are beſt able to conduct and manage ſuch Papers through the Hands of unruly Men, ſuch as the Gravers are, as being excellently well skilled in that Art. However, I think it will be very obliging in you, to offer to my Lord of *London* your Service in that kind, before my Lord ſhall have otherwiſe diſpoſed of them.

In the mean time, to give you a ſlight touch out of my Papers of what he was doing, I will extract a Line or two out of Three or Four Letters which I received from him.

Virginia, May 5. 1668.

I have ſent you what Variety of Land or Freſh-water Snails our Country affords, at leaſt what I have obſerved in it, of thoſe I did receive about 10 *or* 12 *Species, which I have taken care to Figure.*

April 19. 1689.

I have ſent you what Muſcles our Freſhes afford, at leaſt what as yet come within my Obſervation.

I received Six Species, which I have cauſed very carefully to be Figured and Graved.

I have alſo ſent a parcel of Drawings rowled up for my Lord of London; *they are moſt of them of Plants common*

mon in our Woods, but poſſibly may be Strangers to the Gardens of Europe.

The Phalangium Spurium *is not that of* Zanoni; *nor the* Dipetalos Braſiliana *of* Margrave. *To the Deſcription I made of it in the Year* 1679. *I find this* Quære, An Gentianella Indica Bontii? *We have an other ſmall one of this kind, that runs upon the ground, which I have not yet drawn. The* Mercurialis *differs little from, if it be not the ſame with the* Mercurialis Zeylanica, *&c.* Herman. Cat. Leyd. App. Vide *Mr.* Ray *in* App. p. 1854.

This is the Catalogue of the reſt of the Figures and Names of Plants then ſent.

Periclymenum perfoliatum ſemper virens & florens.

Helleborine Ophiogloſſii Folio.

Securidaca frifolia flore patulo cæruleo, radice Glycyrhizæ ſapore.

Cacalia foliis rotundioribus ad caulem ſeſſilibus.

Crotolaria Americana hirſuta minor, herbacea, caule ad ſummum ſagittato Herman. Append.

Pſeudo-Lathyrus luteus, glaber, & hirſutus, ſiliquis tumentibus nobis in Catalogo.

Here he makes mention of a Catalogue which he ſent in the Year 1679. to the Biſhop of *London.*

Convolvulus monococcos.

Mercurialis Hermophroditica tricoccos, ſeu Julifera ſimul & fructum ferens. Mercurialis Zeilanica tricoccos cum acetabulis. Kupampruja Zeilanenſibus, Herman. Cat. Leyd. fortè.

Fungus Holoſericeus infernè lamellatus, ſupernè ab inſertione, concharum more ſtriatus, & tranſverſim faſciatus.

Fungus parvus rubellus ſubtus poroſus.

Fungus pulverulentus, cute duplici, coriacea ſcilicet & membranacea tectus.

Muſcus rupeſtris repens claviculis folioſis, erectis, quadratis.

Pſeudophalangium ramoſum, majus, erectum.

Blitum Spinoſum.

Ariſarum Tryphyllon.

Laurus Tulipifera baccis rubellis, cono erecto capſulato incluſis.

Muſcipula Regia, ſeu Lychnis viſcoſa flore amplo coccineo.

Ricinus lacteſcens fici foliis, ſpinulis mordacibus armatus.

Ulmaria major trifolia flore amplo pentapetalo.

Gnaphalium alterum Americanum.

N. 1, 2. (*N.B.* Theſe Tables I ſuppoſe are with the reſt of his Papers.)

At the bottom of the Table of Inſects are of thoſe ſort of Flies that Mouffet *calls* Muſca Lupus. *I have obſerved that theſe, and ſome others, as the* Tabani, Aſili, *&c. that have but two Wings, have growing out of their Body, under each Wing, a ſmall flexible* Apex *or* Pointel, *with which they poiſe their Body, and keep it in* Æquilibrio, *as the Dancer of the Rope does with his Pole; for pull theſe off, and their Flight is ſhort and unſteddy: Nor can they, tho' they have the uſe of their Wings, guide themſelves ſo, as to keep themſelves from the ground, or to avoid ſtriking againſt, whatever is in their way.*

At the Top of the Table, *Tab. n.* 1. Veſpa Ichneumon fuſca. 2. Veſpa Ichneumon atro-cærulæa. 3. *The* Nympha *common to them both.* 4. *Their Houſes which they make of Dirt.* 5. *The Spiders with which they hatch their*

their Young. 6. *A ſpurious Brood of ſome other* Ichneumon *ſometimes found in their Neſts.*

Virginia, Aug. 2. 1690.

Amongſt a parcel of Plants, Shells, Inſects, &c. *by me tranſmitted this year,* (to whom I know not; he means, I ſuppoſe, Draughts and Figures) *be pleaſed to accept of this ſhort Deſcription of a* Land-Snail,*whoſe Figure is that* N. 1. 1. *The out-ſide is of an Aſh colour, inclining to a Yellow, the in-ſide White, with a Bluſh of Red; and in the middle of the Entry on the* Inturn *of the Shell, grows a ſmall white Tooth, or Protuberance. But what is moſt remarkable, the Shell its ſelf is tranſparent; and you may plainly perceive by the Opacity there, that the Body of the Animal lies near the Spiral String or Center, on which the Arch is turned, and that the Empty part of the Shell is ſpread with a thin ſpotted Film. Near the Tooth, but more inward, is to be ſeen a little wateriſh Speck, which by a kind of* Syſtole *and* Diaſtole *contracts and dilates its ſelf; from this proceeds a lympid Trunk, which runs into the Film, and there divides into Branches: Theſe grow leſſer, and ſpread as the Animal recedes or approaches the Mouth; and when it is out, extend themſelves to the very Lip of the Shell. I ſuppoſe the ſame to be in all, at leaſt the Land-kind, tho' not eaſily to be diſcerned. It is likely alſo, that the Film, the* Nautilus *or* Carvil *(as the Sailors call it) exerts, may be analogous to this.*

This Deſcription of the Heart of a Snail agrees well with the Anatomy thereof, made, and long ſince publiſhed by *Harder*; alſo with that other Anatomy of the ſame Animals, by *Franciſcus Redi.*

Virginia, May 12. 1692.

I have ſent you another parcel of Freſh-water *and* Land Snails, *in which I believe ſome are new.* [And ſo there was divers Species, all which I have carefully cauſed to be graved.] *There is a ſmall one of the Land-kind, with a dented* Aperture, *that I formerly ſent ; Time had worn that Shell ſmooth and white ; but I lately found it with an outward Coat, on which it is hirſute, or rather finely echinated. I am apt to believe that theſe, nor hardly any elſe are dented, till they are at their full growth ; for you will find ſeveral ſmall ones amongſt theſe with an open entrance, that ſeem to belong to this kind.*

I hitherto obſerved very little Variety of Naked Snails ; *I know of but one kind, which is a ſmall Aſh-coloured and ſpotted one, and milkey like yours,* Tit. XVI. *but ſome of theſe I wonld have ſent, but,* &c.

I ſend you the Originals, that you may ſee I have done fairly by my Friend in the Extracts ; which I deſire you to keep among the Society's Papers.

April, 18. 93. *Yours*, &c.

VI. *An Account of digging and preparing the* Lapis Calaminaris, *in a Letter from Mr.* Giles Pooley *to Sir* Robert Southwel *Preſident of the R. S.*

SIR,

I Promis'd a long while ago to give you an Account of the *Lapis Calaminaris* which is digged and prepared here near me ; that I have not, as I intended long before this performed that Promiſe, I hope your kindneſs will excuſe, being I have been taken off by ſome neceſſary occaſions from making my Enquiries hitherto concerning it; and underſtanding that it did not require any great haſt, ſo that I hope this following Account will not come too late.

As to the finding out the *Calamine*, which I think the firſt thing to inform you of, the *Groovers* tell me there is no certainty at all, but that it is a meer Lottery: They are neither certain of it from the Surface of the Earth, which, as they obſerve, gives little or no ſigns thereof; ſometimes they ſay an oily Steam and Smell ariſeth out of the Earth where they gueſs ſome Mines to be, but not *Calamine*; nor from the Nature of the Ground, it being found ſometimes in Meadows, ſometimes in Arable, ſometimes in Paſture; and as I have obſerved, moſt commonly in barren and rocky Ground: Neither from the Colour or Taſte of the Waters running thereabouts, they being much of the ſame Colour, Taſte, Clearneſs and Wholſomneſs with other Water: Nor from the withering of the Graſs upon the Superficies of the Earth, or the Leaves of the Trees, they being as freſh where *Calamine* lies, as in any other place. But this I obſerve, that they always dig for it upon, or near the Hills; for they expect none in thoſe Grounds which have no Communication with Hills.

The Method they take for finding out a Vein is by digging a Trench as deep as till they come to the Rocks where they expect it lies, acroſs the place where they hope for a Courſe; which Trench they generally dig from North to South, or near upon that Point, the Courſes uſually lying from Eaſt to Weſt, or at Six a Clock, as their Term is. Though this is not conſtant neither; for ſometimes the Courſes, Seams or Rakes as they call them, lie at Nine a Clock, and ſometimes are perpendicular, which they call the High time of the

Day,

Day, or Twelve a Clock; and theſe Courſes they eſteem the beſt. Theſe Seams or Courſes run between the Rocks, generally wider than thoſe of Lead-Ore, unleſs they are incloſed in very hard Cliffs, and then they are as narrow as the Veins of Lead. The Colour of the Earth where *Calamine* lies, is generally a yellow Grit, but ſometimes black; for all Countries, as they term their under-ground Works, are not alike. *Calamine* it ſelf is of ſeveral Colours, ſome white, ſome reddiſh, ſome greyiſh, ſome blackiſh, which is counted the beſt; but when this is broken, it is of ſeveral Colours. In working for it below in the Countries, they uſe the ſame way and Inſtruments as they do in Lead-Mines; and ſometimes they light upon a good quantity of Lead, but always find ſome Eyes of Lead among the *Calamine*, which in ordering of it they ſeparate: Though I think in Lead Mines they do not always find *Calamine*. In landing of the *Calamine* ſome pieces are bigger than others of different ſizes, as other Stones are, and mixt with the gritty Earth; yet I have been informed by a Perſon concerned in theſe Works, that they have found one entire piece of 8 or 10 Tun, which by reaſon of its bigneſs was forc'd to be broken in the Groove before it could be landed; but generally in theſe Grooves where I made my Enquiry, it riſeth in ſmall Particles, ſome more, ſome leſs, and ſome about the bigneſs of a Nut, and this they call a ſmall *Calamine*. In ancient Works, (which are thoſe that have been forſaken and afterwards workt in again) Damps and Staunches ſometimes ariſe, but never in new Works; but that theſe Damps ariſe, an experienc'd Groover tells me is the Fault of thoſe Workmen, that do not take care to carry Air along with them, which is done by Air-Shafts, as in Lead-Mines.

When they have landed a good quantity of this *Calamine*, which is done by winding it up in Buckets from their Works, they carry it away to the places where they waſh, clean or buddle it, as their Term is, which they perform after this manner. They encloſe a ſmall piece of Ground with Boards or Turfs, through which a clear Stream of Water runs; within this Encloſure they ſhovel their *Calamine* with the reſt of the impure and earthy parts; and theſe impure and earthy parts the running Water which comes in at one end of the Encloſure carries away at the other end, and leaves the Lead, and the *Calamine*, and the other heavier ſtony and ſparry parts behind; and for the better cleanſing or buddling the *Calamine* while it is in this Encloſure, they often turn it, that ſo the Water paſſing through may waſh it the better: When they have thus waſhed it with this running Stream as clean as they can, having rak'd up the bigger parts both of the Lead and the *Calamine*, they afterwards put the ſmaller parts, that they may loſe none of their Ore, into Sieves made of ſtrong Wire at the bottom; and theſe Sieves, with the *Calamine*, Lead, and the Remainder of the earthy, ſparry and ſtony parts which the Water could not waſh away, they often dip and ſhake up and down in a great Tub of Water, by which ſhaking of the Sieves, the parts of the Lead which is mixt amongſt the *Calamine* ſink or pitch down to the bottom of the Sieves, as being heavieſt, the parts of the *Calamine* in the middle, and the other ſparry, ſtony and traſhy parts riſe up to the top, which as they riſe, they skim off, and throw among the reſt of the Rubbiſh, and then they take off the *Calamine*, and after that the Lead. When they have thus cleanſed the *Calamine* as well as they can, it being not yet clean enough, they are forc'd to ſpread it upon a Board, and ſo pick out with their hands the traſh and ſtones that remain. I cannot tell whether you will apprehend this Deſcription of their buddling the ſmaller *Calamine*; but you muſt know that all of it doth not require ſo much trouble; for ſome riſeth big enough out of the Works to be cleanſed and pickt fit for the Calcining Oven without all this Charge and Pains: And I have ſeen ſeveral Loads of this great *Calamine*, which had no mixture of Earth or Traſh in it.

After they have prepared their *Calamine* by waſhing and picking, they then carry it to the Oven, which, at leaſt that which I ſaw, is much bigger than any Bakers Oven, and made much in the ſame Faſhion, only this way of heating, burning or baking the *Calamine* is different; for it is not done as bread is; for they caſt in their Coals into a Hearth made on one ſide of the Oven, which is divided from the Oven it ſelf by a Hem or Partition made open at the top, whereby the Flame of the Fire paſſeth over, and ſo heats and bakes the *Calamine*. They let it lie in the Oven for the ſpace of Four or Five Hours, the Fire burning all the while, according to the ſtrength of the *Calamine*, ſome being much ſtronger than other, and ſo requiring longer time; and while it continues in the Oven, they turn it ſeveral times with long Iron Cole-rakes; when it is ſufficiently burnt, baked and dried, they beat it to a Powder with long Iron Hammers like Mallets, upon a thick Plank, picking out what Stones they find amongſt it; ſo that at laſt the *Calamine* is reduced to Duſt: From the Oven it is conveyed in Sacks to ſome Port, where being bought by the Merchants, it is carried beyond-Sea, commonly I think to *Holland*, whether I refer you to be further informed concerning the uſe of it. I made enquiry what Medical or other Vertue there was known to be in it, and I have been informed by ſeveral credible Perſons, that the Duſt of *Calamine*, contrary to other Duſt which blinds, doth conduce much to the curing of ſore Eyes of Men, and that it is frequently made uſe of for the taking of Films from the Eyes of Horſes and other Beaſts. I hear alſo that they ſell good quantities of it to the Druggiſts of *London*, but for what uſe I know not. This is all I could learn concerning *Calamine*. If I have omitted any thing wherein you are deſirous of further Information; or if in any other Concern of this Nature I can be ſerviceable, you may freely command,

Wrington,
Oct.25.84.

Yours, &c.

VIII. *An Arithmetical Paradox, concerning the Chances of Lotteries*, *by the Honourable* Francis Roberts, *Eſq*; *Fellow of the R. S.*

AS ſome Truths (like the *Axiomes* of *Geometry* and *Metaphyſicks*) are ſelf-evident at the firſt View, ſo there are others no leſs certain in their Foundation, that have a very different Aſpect, and without a ſtrict and careful Examination rather ſeem repugnant.

We may find Inſtances of this kind in moſt Sciences.

In *Geometry*, That a Body of an infinite Length may yet have but a finite Magnitude.

In *Geography*, That if *Antwerp* be due Eaſt to *London*, for that reaſon *London* cannot be Weſt to *Antwerp*.

In *Aſtronomy*, That at the *Barbadoes* (and other places between the Line and Tropick) the Sun, part of the Year, comes twice in a Morning to ſome Points of the Compaſs.

In *Hydroſtaticks*, That a hollow Cone (ſtanding upon its Baſis) being fill'd with Water, the Water ſhall preſs the bottom with three times the Weight, as if the ſame Water was frozen to Ice; and Figures might be contrived to make it preſs a hundred times as much.

Theſe Speculations, as they are generally pleaſant, ſo they may alſo be of good uſe to warn us of the Miſtakes we are liable to, by careleſs and ſuperficial reaſoning.

I ſhall add one Inſtance in *Arithmetick*, which perhaps may ſeem as great a Paradox as any of the former.

There are two Lotteries, at either of which a Gameſter paying a Shilling for a Lot or Throw; the Firſt Lottery upon a juſt Computation of the Odds has 3 to 1 of the Gameſter, the Second Lottery but 2 to 1; nevertheleſs the Gameſter has the very ſame diſadvantage (and no more) in playing at the Firſt Lottery as the Second.

It looks very like a Contradiction, that the Diſadvantage ſhould be no greater in playing againſt 3 to 1 than 2 to 1, but it may thus be reſolv'd.

$$\text{Let the}\left\{\begin{matrix}\text{1ſt.}\\ \text{2d.}\end{matrix}\right\}\begin{matrix}\text{Lottery con-}\\ \text{ſiſt of}\end{matrix}\left\{\begin{matrix}3\\ 4\end{matrix}\right\}\begin{matrix}\text{Blanks}\\ \text{and}\end{matrix}\left\{\begin{matrix}3\\ 2\end{matrix}\right\}\begin{matrix}\text{Prizes}\\ \text{of}\end{matrix}\left\{\begin{matrix}\text{16 pence}\\ \text{2 ſhill.}\end{matrix}\right\}\text{a piece.}$$

In the firſt Lottery the Gameſter hazards a Shilling to win a Groat, and the Chances being equal, it is evident there is 3 to one againſt him.

In the Second Lottery the Gameſter ventures a Shilling againſt a Shilling, and the Lots being 4 to 2, his Diſadvantage is 2 to 1.

And a Lot at either of them being truly worth juſt 8 Pence, (*viz.* the 6th part of 3 times 16 Pence, or twice 2 Shillings) the Diſadvantage muſt be the very ſame in both Caſes, that is, the Gameſter pays a Shilling for a Lot that is worth but 8 Pence.

The Method of finding this Anſwer being ſomewhat out of the common Road, I ſhall here add it, and thereby infinite Solutions of the ſame kind may be diſcovered.

1*ſt* Lottery.	2*d* Lottery.
Let a = the number of Blanks.	m = the number of Blanks
b = the number of Prizes.	n = the number of Prizes
r = the Value of a Prize.	s = the value of a Prize.

1 = to what you pay for a Lot, *viz.* a Shilling.

So the Lottery has it's Chances for 1, and the Gameſter his for $r-1$. Now the true Odds conſiſting of the compounded Proportion of the Chances and the Values, *viz.* $\frac{a}{b}$ and $\frac{1}{r-1}$, the Share of the Lottery will be a, and that of the Gameſter $rb-b$. Therefore as the preſent caſe ſtands, the firſt Lottery muſt be $a=3rb-3b$, and by the like reaſoning the ſecond Lottery will be $m=2sn-2n$. Now the Value of a Lot being the Sum of the Prizes divided by the number of Lots, (which muſt be equal in both Lotteries) it yields $\frac{rb}{a+b}=\frac{sn}{m+n}$. So to proceed.

$$\left.\begin{array}{l} a\\ b\\ r\\ m\\ n\\ s \end{array}\right\} = ? \quad \begin{array}{l|l} 1 & a=3rb-3b \\ 2 & m=2sn-2n \\ 3 & \dfrac{rb}{a+b}=\dfrac{sn}{m+n} \\ 4 & (*) \\ 5 & (*) \\ 6 & (*) \end{array}$$

q. =

$q = ?$	7	Let $\frac{rb}{a+b} = q$
$7 * \overline{a+b}$	8	$rb = qa + qb$
$8 \times \overline{3}$	9	$3rb = 3qa + 3qb$
$1 + 3b$	10	$3rb = a + 3b$
9, 10	11	$3qa + 3qb = a + 3b$
Scope	12	If $a = o$ to avoid negative Numbers.
11, 12	13	$3b = 3qb$
$13 \div 3b$	14	$q = 1$
12, 14	15	$q > 1$ makes $a < o$ $q < 1$ makes $a > o$
Scope	16	If $b = o$
11, 16	17	$3qa = a$
$17 \div 3a$	18	$q = \frac{1}{3}$
16, 18	19	$q < \frac{1}{3}$ makes $b < o$ $q > \frac{1}{3}$ makes $b > o$
3, 7,	20	$\frac{sn}{m+n} = q$
$20 * \overline{m+n}$	21	$sn = qm + qn$
$21 * 2$	22	$2sn = 2qm + 2qn$
$2 + 2n$	23	$2sn = m + 2n$
22, 23	24	$2qm + 2qn = m + 2n$
Scope	25	If $m = o$
24, 25	26	$2qn = 2n$
$26 \div 2n$	27	$q = 1$
25, 27	28	$q > 1$ makes $m < o$ $q < 1$ makes $m > o$
Scope	29	If $n = o$
24, 29	30	$2qm = m$
$30 \div 2m$	31	$q = \frac{1}{2}$
29, 31	32	$q < \frac{1}{2}$ makes $n < o$ $q > \frac{1}{2}$ $n > o$
15,19,28,32	33	that $a\ b\ m\ n$ may be $> o$, q muſt be $> \frac{1}{2} < 1$

33, 4 (*)	34	Let therefore $Q =$
7, 34.	35	$\frac{rb}{a+b} = \frac{2}{3}$
35 *, 10	36	$3rb = 2a + 26 = a + 3b$
36 —	37	$a = b$

20, 34.	38	$\frac{sn}{m+n} = \frac{2}{3}$
38 * $\underline{\ }$	39	$3sn = 2m + 2n$
39 * $\underline{2}$	40	$6sn = 4m + 4n$
23 * 3	41	$6sn = 3m + 6n$
40, 41	42	$4m + 4n = 3m + 6n$
42 —	43	$m = 2n$

1 ÷ 3$\underline{7}$	44	$1 = 3r - 3$
44 + $\overline{3}$	45	$3r = 4$
2 ÷ n, 43	46	$2 = 2s - 2$
46 + $\overline{2}$	47	$2s = 4$

5 (*)	48	Let $A = 3$
37, 4$\underline{8}$	49	$B = 3$
45 ÷ 3	50	$R = \frac{4}{3}$, id eſt, 16 Pence.
6 (*)	51	Let $M = 4$
43, 51	52	$N = 2$
47 ÷ 2	53	$S = 2$ 2 Shillings.

VIII. An Account of BOOKS.

I. *Horti Indici Malabarici.*

Pars Quarta, Quinta & Sexta.

With ſome Remarks upon them by T. R. M. D. *S. R. S.*

THE three firſt Volumes of this Work having been taken notice of in the *Philoſophical Tranſactions*, N. 155. from *pag.* 100. to *pag.* 109. I ſhall continue the Account of the reſt, in which the *Heer Van Rheede* (lately the Worthy Governour of *Malabar*, now chief *Intendant* of all the *Dutch Colonies* in *India*) gives a moſt illuſtrious Specimen of his Induſtry and Generoſity, as alſo a noble Example to other *Reſidents* in Foreign Countries, having at leiſure Hours Collected, Deſign'd, Painted, Deſcrib'd, and learnt the Natural Products, together with their Uſes in Trade, Diet and Medicine; and all in order to communicate his Diſcoveries to the World, amidſt his many great Employments in the Commonwealth both at Home and Abroad.

This Fourth Tome contains Sixty One Trees, Shrubs and Arboreſcent Herbs, together with their Sculps and Deſcriptions from the Life; particularly of their Flowers, Fruits, Seeds, and their Veſſels, (the Symbolical and Eſſential Marks of Plants) neglected, or elſe unobſerved by the *Ancients*, whoſe *Genius* and *Spirit* penetrated very deep in moſt things, except Natural Hiſtory, in which they are very obſcure, confus'd, and unintelligible, even to the niceſt *Criticks*, and all for want of deſcribing things with their proper Characteriſtic Notes, which clearly diſtinguiſh them one from another. In the laſt Age this was firſt ſtarted by the laborious and learned *Geſner*, afterwards proſecuted by thoſe two *Italian Wits*, *Andreas Cæſalpinus*, and *Fabius Columna*, but lately moſt improv'd by our own deſervedly famous *Country-man* Mr. *John Ray* in his excellent *Hiſtories* of *Plants* and *Animals*.

The Exactneſs and Accuracy of the Moderns far above the *Ancients* in this part of Knowledge is ſo plain to any Man of common Obſervation or Reading, that I cannot but wonder ſome ſhould ſpeak ſo contemptuouſly of the laſt Ages, as tho they only copied or commented thoſe that went before; No uſeful Inventions? No Improvements amongſt us? This may paſs amongſt ſome *Smatterers* in Philoſophy, or *Ancient Bigots*, but never with Men of *Science*, or *free Thought*; nor indeed with any *Body* tolerably vers'd in the Hiſtory of Nature or Arts: So little need is there of *Tranſcribing* (as ſome fancy) the *Old Books*, that if we join both all the *Ancient* and *New* together, they will ſcarce make above an *Eſſay* towards the Diſcovery and Knowledge of almoſt *Infinite* and *Inexhauſtible Nature*. *Veniet tempus, quo iſta, quæ nunc latent, in lucem dies extrahet, & longioris ævi diligentia*, was the Opinion of the *Ancients* themſelves. But to the preſent *Work* before us, of which ſome particulars are to be touch'd upon.

Amongſt the many rare Vegetables, we have a compleat Hiſtory of that Pruniferous Tree, called *Mango* by the *Engliſh*, *Mao* or *Mau* by the *Indians*, *Ambo* by the *Brachmans*, which grows above 40 foot in height, and 18 in thickneſs, ſweating out an odoriferous gummy Subſtance; its Leaves and Root are of an Aromatick Quality; the Flowers grow in Cluſters like thoſe of the Vine, are pentapetaloſe, white, and marked within with a yellow Spot, and a Honey Spicy *Style*, to which ſucceeds the Fruit of the Figure of a Kidney, as large as a Gooſe Egg, firſt green and checquered with white *Punctums*, then yellowiſh, and afterwards of a Golden Colour, with a thin downy Skin; the Stone is oblong flattiſh, and lanuginoſe, the Kernel whereof reſembles that of an Almond; of theſe there are as many varieties in *India*, as Peaches and Plums in *Europe*: The Wood is in uſe amongſt the *Gentiles* in burning their Dead Bodies, to which 'tis conſecrated, and for making their Coffins or Urns. The *Brachmans* adorn their Habitations with the Boughs on Feſtival days, they rub their Teeth with the Leaves, and uſe them as they do the *Betel* and *Fauſel*, (the firſt of the *Pepper*, the latter of the *Palm* kind) the Gum is given in all ſorts of Fluxes. The Fruit is either eaten out of Wine, or Pickle, or in Conſerve, ſometimes ſtuft with freſh Ginger, Garlick, Muſtard, *&c.* and ſprinkled with Salt, Oyl and Vinegar, and ſo eaten with Rice and other Meats, as we do *Gurchens* and *Olives*. Out of the dry'd Kernels they make a Meal, of which they prepare ſeveral ſorts of Meat.

To this we might add the Hiſtories of many other exotick and rare Trees deſcrib'd, and elegantly Figur'd in this Fourth Part, as the *Adamaran*, a ſort of Almond-Tree, out of which the *Indians* make Cakes, milky Emulſions, and an Oyl by Expreſſion; it bears Fruit three times in one Year. *Panem-Palka* a Species of Nutmeg, which the *Turkiſh* and *Jewiſh* Merchants ſometimes ſubſtitute inſtead of the true with the Mace on it, and ſell the Oyl for genuine. The *Samſtravadi*, with the Flowers and Fruit whereof the *Ethnick* and Superſtitious Pilgrims deck their Bodies after having Conſecrated them; the *Portugueſes* call it *Roſairos*, numbring their Prayers with them inſtead of Beads; 'tis a ſort of Plum call'd *Jambos*, of which there are ſeveral Species in this Volume. *Paënoe*, out of which when young, the *Indians* make their Maſts, and entire Veſſels out of the grown Trunks, capable of holding 60 Men ; they flouriſh above 300 years, and afford a ſort of Gum *Anime* or *Copal*, us'd by the Natives as Frankincenſe in their Sacrifices. The Timber is not eaſily ſubject to the Worm. *Poerinſii*, a ſort of Soap-Tree, with the Fruit whereof they waſh, and make their Combs and Muſical Inſtruments out of the Wood. *Ponga*, like unto the *Tataiba* of *Piſo*, or the *Fuſtick-Wood* Tree. *Ponna*, diſtilling a Subſtance like the *Gutta Gamba* or *Gummi Gotte*, with which it agrees in many qualities. *Tſierou-Ponna*, call'd *Kina*, in the Iſland of *Ceylon*. *Perin-Toddali*, a ſort of *Zyzyphus* or *Jujube* diſtilling our common *Lacca*. *Ravapou*, a ſecond kind of *Arbor Triſtis*, a-kin to the Jaſmins ; this is very fragrant, and expands upon the riſing of the Sun. *Bengieiri*, whoſe Wood reſembles the *Lignum Moluccenſe* or *Panave*. *Aria Bepou* which is the true *Nimbo* of *Acoſta*, of which there are two Species. To theſe we might add ſome Indian *Ricini*, *Ciſti*, ſeveral kinds of *Limes*, *Althæa's*, Plums, Oriental Elder, Barberry, &c. with their Uſes, all contain'd in this Fourth Tome.

Horti Indici Malabarici.

Pars Quinta.

THis Fifth Volume comprehends 60 Trees and Shrubs, moſt of them Bacciferous, excellently engraven in large Copper Plates. The *Katou-karua* is a Second Species of Cinnamon obſerv'd wild in ſeveral Provinces of *Malabar*, the other ſort being deſcribed in the firſt part of this Work under the Name of *Karua*, both inferiour to the Cinamon-Tree growing in the

Woods of *Ceylon*, tho' all alike in Leaf, Flower and Fruit. *Beeſha*, whoſe Leaves are arundinaceous, a-kin to the *Ily* or *Bambou Cane* deſcribed in the firſt Tome, out of the *Beeſha* the Natives make their Baskets, Arrows, and Writing Pens. *Nola-Ili*, a third Species of *Bambou*, ſent as Merchandize into *Perſia*, *Arabia*, and the *Turkiſh* Empire, where they make long Pipes of it for the ſmoaking their Tobacco. *Cammetti*, a ſort of Tree Tithymal or Spurge above Forty Foot high, with the Decoction whereof they kill Worms, and cure Ulcers: The milky Juice of this Plant mixt with the Powder of *Carcapula* (*a ſort of Gutta Gamba or Gemou*) is ſaid to perform Wonders in Dropſies. Many of the reſt contain'd in this Fifth Volume may be referr'd to our *Vitis Idæa*, to the *Myrtles*, the *Lauriſtines* or *Wild Bays*; to the *Rhamnus*, *Euonymus*, &c. all which the *Indians* apply to many uſes in Phyſick, Mechanicks, and Agriculture.

Horti Malabarici.

Pars Sexta.

IN this Sixth Volume we have deſcrib'd and figur'd 61 Trees and Shrubs, the greateſt part whereof are Siliquoſe, as the *Tſetti-Mandarum* call'd by *Breynius Frutex Pavonius* ſive *Criſta Pavonis*, and by the *Portugueſes*, *Flos Pavonius*, from the Pride and Figure of its Flower. Its Seed is not unlike that of *Aldinus* his *Acacia* in the *Farneſian* Garden, yet it ſeems a-kin to the *Senna* kind.

Tſiapangam, call'd by the Dutch *Raſphout*, not unlike the Red Wood of *Braſil* in all its parts, and in the dying Trade, for which 'tis ſold up and down. The *Lobe* or *Pod* is figur'd by *Cluſius* in his *Exhot. l. 3. c. 16.* But here we have the full Hiſtory of it.

Mouricou, commonly call'd the *Coral Tree*, of which there are ſeveral Species in both *Indies*; 'tis ſpinoſe, and trifoliate, the Flower and Seed of a coccineous Colour. In the Iſland of St. *Maurice* it exceeds in height all the other Trees, therefore 'tis called *Elephantina.* It's Trunk is loaded with Snails, and the *Pepper-Shrub* often climbs up it like Ivy. Out of the Wood the Natives make Sheaths for Knives and Swords, and with it and a calcin'd Stone they poliſh Perſpective Glaſſes; with the Bark they waſh their Veſts called *Saraſſas*, and make the Confection *Caril* out of the Flowers.

Wellia Tagera, call'd in ſeveral places of *India Coupang*, of great uſe and ſucceſs in gouty caſes, as the *Kopang*-Tree of *New England* is reported to be by our Planters; hence ſome ſtyle it *Arbor Antiarthritica.*

To theſe we might add the *Katou-Conna*, a ſort of *Caſſia Fiſtula.* The *Thora Paerou* or *Cajan-Tree*, an arboreſcent *Phaſeolus* or *Laburnum*, much cultivated at the *Cape*, affording a moſt refreſhing Pulſe to the Sea-men. *Mandsjadi*, with whoſe Seed they weigh Pearls. *Niir-Pongelion*, whoſe long trumpet Flower reſembles that of *Dutroy*; Parrots are ſaid to be much delighted with the Fruit, and the *Indians* make Nets of the Boughs and Root. *Iſora-Murri* with its Conical Pod wreathed Spirally. Here are alſo many ſorts of *Kandel*-Trees, ſome of which are a-kin to the *Mangrove* of *America*. The *Hina-Pareti*, or *Roſa Sinenſis*, with many other elegant *Alcea's* and *Althæa's*. The *Moringa*, with ſeveral curious *Acacia's* and *Colutea's*. Many of the reſt may be refer'd to *Cluſius* his Exotick Lobes and Fruits, which this Volume doth much illuſtrate, the latter part whereof exhibits ſome *Indian* Jaſmines, and large Capers, belonging rather to the Bacciferous Tome.

A Treatiſe of the Roman *Ports and Forts in* Kent. *By* William Somner, *&c. To which is prefixt the Life of* Mr. Somner. *Printed at* Oxford *at the* Theatre, *in* 8°. *1693.*

THIS Book treating more of Antiquities than Natural Philoſophy, will upon that account claim leſs room in theſe Tracts; wherefore our Account thereof ſhall be accordingly ſuccinct.

The Life of the Author taking up the greater part of the Book, is wrote by an ingenious Gentleman, who therein commemorates ſeveral great Patrons of Learning;

ing; next he ſhews the Pains our Author took to acquire the *Saxon* Language, then almoſt loſt, of the gradual Decay of which Language he gives a ſhort Hiſtory. Then he gives an Account of our Authors other Studies and Works; whence it appears he intended a compleat Treatiſe of the Antiquities of *Kent*, this of the *Roman* Ports and Forts being a part thereof. Speaking of the Difficulties of compiling Treatiſes of this Nature, he gives a ſhort View of ſeveral Antiquaries, and their Deſigns and Labours, moſt whereof are unpubliſh'd, and many loſt. He gives an Account of our Authors Treatiſe of Gavel-kind, publiſh'd in the year 1660, in 4*to.* His *Saxon* Dictionary; and concludes with a Liſt of his Poſthumous Manuſcripts.

In the Treatiſe it ſelf the Author begins with *Rutupium*, and rejecting other Opinions, places it at *Sandwich*, making *Richborough* Caſtle a *Pharus* to guide the Sea-men into the Harbour, and makes *Geſſoriacum*, more anciently *Portus Iccius*, to be *Bolen*; which *Rutupium* he ſays was then, and ſometime after called *Lundenwich*, at which place he affirms *Cæſar* firſt landed; tho the Author of the Life allows of Mr. *Halleys* Account thereof publiſh'd in a late Tranſaction. As to the *Goodwyn Sands*, he denies them ever to have been firm Land; they are more ſoft, fluid and porous, and yet tenacious, and conſequently more voracious than other Sands, which are harder, ſolider and rockier. Since they are not mentioned by any Writers of great Antiquity, he believes they may be of late Emergency, and poſſibly cauſed by the great Inundation in *Flanders* about *William* the Second's, or *Henry* the Firſt's Time; the receſs of which Water from theſe places probably left the *Goodwin Sands* ſhallower than formerly.

Next our Author ſpeaks of *Dubris*, now *Dover*: To omit his Derivation of the Name, he obſerves it was a *Roman* Port, and has all along ſo continued. *Bolen* on the *French* Coaſt, and *Rutupium* on the *Britiſh*, being in

time

time ſupplanted, the one firſt by *Witſand*, and at laſt by *Calis*, the other by *Dover*, at which place our Author makes *Cæſar* to have firſt attempted to land: The Fortification of the place in thoſe days was more from Nature than Art. The Rock being cut into ſuch Indentures, as reſembled and were inſtead of Walls with Battlements, which Time hath now worn away. Proceeding to the Port of *Lemanis*, which he makes new *Romney*, ſo called from being the *Romans* Port; and which altho for ſome Hundreds of years it has lain dry, yet had formerly a fair and commodious River running by it, and emptying it ſelf into the Sea, much nearer the Town than now, where he endeavours to ſhew, that there was formerly a River of the name of *Rother*, *Romney* and *Limene*, and that it had its mouth at or by *Romney*; and when, and upon what occaſion it forſook its wonted Channel. The two firſt he proves by old Records, where he obſerves that it's Mouth was wide enough to receive a Fleet of 250 Sail of *Daniſh* Pirats, *An.* 893. which towed up their Veſſels Four Miles within the Land; which place it hath now ſo forſaken, that there is neither Harbour nor Channel, which was turned another way by a great Inundation of the Sea about the year 1287. and ſo the Haven loſt for want of the River to ſcour and keep it open. Next he gives the Derivation of *Romney*, *Apledore*, *Gilford* and *Winchelſey*. And ſo much for the *Ports*.

As to the *Forts*, he begins with *Regulbium* now *Reculver*, where are ſtill the Remains of *Roman* Tile; here he obſerves by the way from Mr. *Burton*, that all places ending in *Cheſter*, ariſe from the Ruines of the Old *Roman Caſtra*, this place being once called *Raculf-ceſter*. All the *Roman* Colonies, &c. being upon Hills, he believes this might be placed on the Aſcent where the Church now ſtands, or in the Church-yard, of which place and its Antiquities he enlarges.

2. The next Fort is *Rutupium*, or *Richborough*, of which before amongſt the Ports. The Remains of the Walls

of this Fort compaſs in almoſt as much ground as the Tower of *London*; here there has been, and ſtill is, more *Roman* Coins found than in any place in *England.*

3. *Dubris* or *Dover*, where he believes the Church to have riſen out of the old *Roman* Fortreſs, and the ſquare Tower in the middle fitted with Holes for Speculation, to have been the very *Roman Specula* or Watch-Tower, and the *Devil's Drop* the Remains of the *Roman Pharos.*

4. *Folkſtone*, a place famous for *Roman* Antiquities, which he ſuſpects the ſame with the *Lapis Tituli* of *Ninius*, taking the Word *Stonar*, where *Lambert* places *Lapis Tituli* to be a Corruption of (and formerly written) *Eſtanore* and *Eſtanores*, ſignifying the Eaſtern Border or Coaſt.

5. *Lim* or *Limhill*, where *Stutfall-Caſtle*, with a large Circuit of 10 Acres, was of old encloſed with a *Roman* Wall, ruined not ſo much by Time, as a Seiſure of its Materials for the building of *Lim-Church* and the Archdeacons caſtellated Manſion. The Name *Stutfall* he derives from *Stod fold*, there being formerly kept and ſtabled a Stud of Mares. This place is alſo called *Shipwey.*

6. The laſt *Kentiſh* Fort is *Anderida* or *Anderidos*, as to the Situation whereof he is leſs certain, whether at *Pemſey*, *Haſtings*, or *Newenden*, tho' he inclines to one of the former. The *Weald* was formerly called *Sylva Andred*, a Deſert place unpeopled, fill'd only with Herds of Deer and Droves of Hogs. He ends this Treatiſe with an Enumeration of the Quit-rents formerly paid out of the Weald, as *Gavel-ſwine*, *Scot-ale*, *Pannage*, *Gate-penny*, *Sumer hus ſilver*, *Corredy*, and *Danger.*

The whole is concluded with a Catalogue of the Lord Wardens of the Cinque-Ports.

An Additional Note to Page 670. *of this Tranſaction.*

MEntion being made in this Letter of Mr. *Baniſters*, of the little Pointel found under the Wings of ſeveral Flies, I thought fit to tranſcribe what Dr. *Hook* ſays concerning the ſame in his *Micrographia*, and to give the Figure thereof, as it is by him deſcribed. See *Lit. Q.* in regard the Book is very ſcarce, *Micrographia*, *Obſerv.* 38. *pag.* 173. 'Whilſt I was examining and conſidering the 'curious Mechaniſm of the Wings, I obſerved that un'der the Wings of moſt kinds of Flies, Bees, *&c.* there 'were placed certain Pendulums, or extended drops (as 'I may call them from their reſembling Motion and Fi'gure) for they much reſembled a long hanging drop of 'ſome tranſparent viſcous Liquor; and I obſerved them 'conſtantly to move juſt before the Wings of the Fly be'gan to move; ſo that at the firſt ſight I could not but 'gueſs, that there was ſome excellent uſe as to the Re'gulation of the Motion of the Wings, and did fancy that 'it might be ſomething like the Handle of a Cock, which 'by vibrating to and fro, might as 'twere open and ſhut 'the Cock, and thereby give a paſſage to the determinate 'Influences into the Muſcles: Afterwards, upon ſome o'ther Trials, I ſuppoſed that they might be for ſome uſe 'in Reſpiration, which for many Reaſons I ſuppoſe thoſe 'Animals to uſe; and methought it was not very impro'bable, but that they might have convenient paſſages un'der the Wings for the emitting (at leaſt) of the Air, if not 'admitting, as in the Gills of Fiſhes is moſt evident. Or per'haps this Pendulum might be ſomewhat like the Staff to 'a Pump, whereby theſe Creatures might exerciſe their 'Analogous Lungs, and not only draw in, but force out the 'Air they live by: But theſe were but Coujectures, and 'upon further examination ſeem'd leſs probable.

An ADVERTISEMENT.

THE Ingenious are deſired, That if they have any looſe Papers relating to the ſame Deſign with thoſe of Sir *William Petty*'s, Printed in this Tranſaction, they will pleaſe to communicate them, which Favour ſhall be acknowledged by the like Communications by the Publiſher.

LONDON, Printed for, and Sold by *S. Smith* and *B. Walford*, Printers to
the *Royal Society*, at the *Princes Arms* in St. *Paul*'s Church-yard. 1693.

BRITISH MUSEUM NATURAL HISTORY

Philosophical Transactions N°.199.

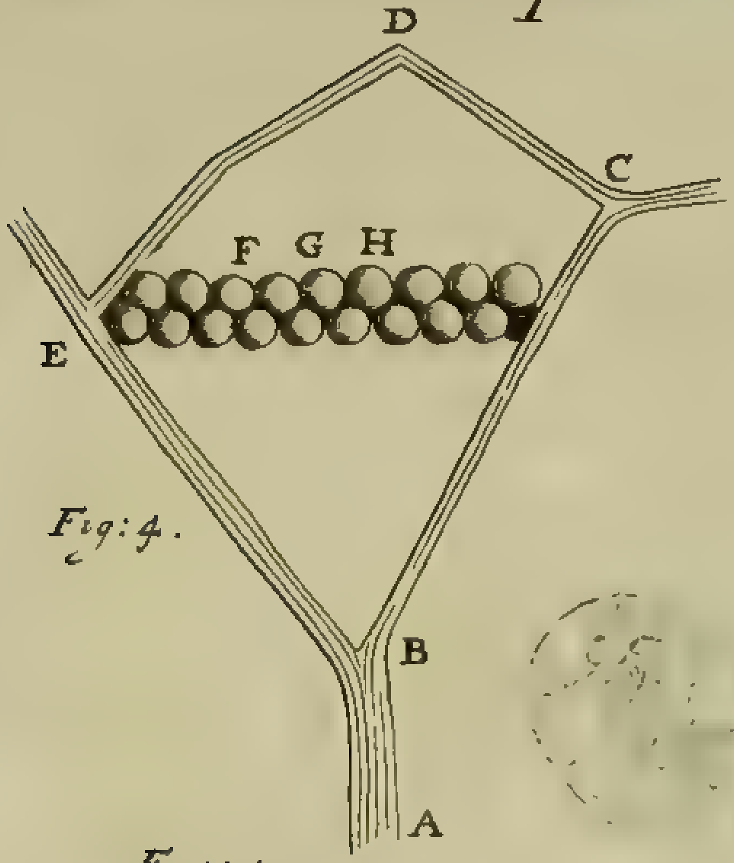

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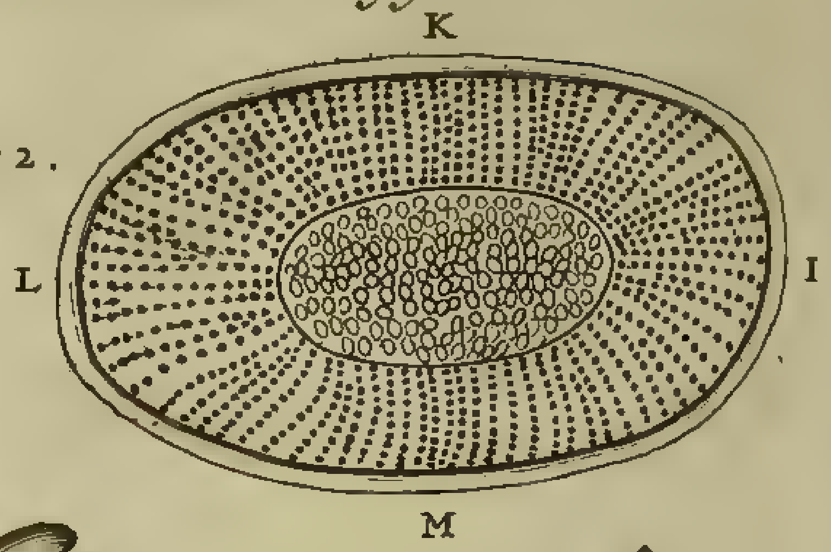
Fig:2.



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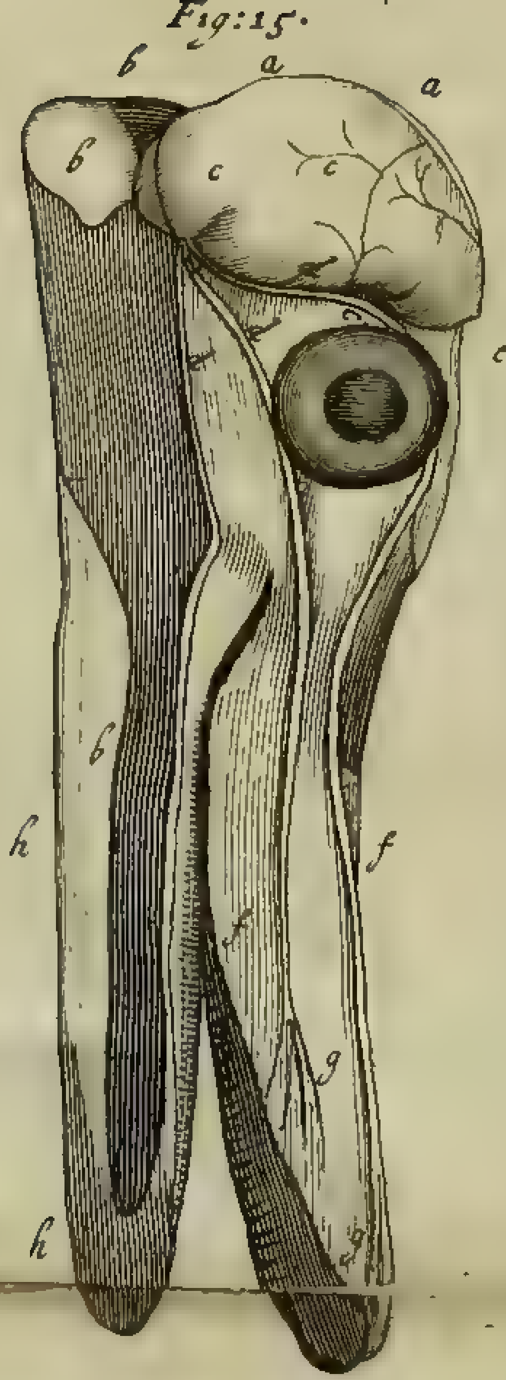

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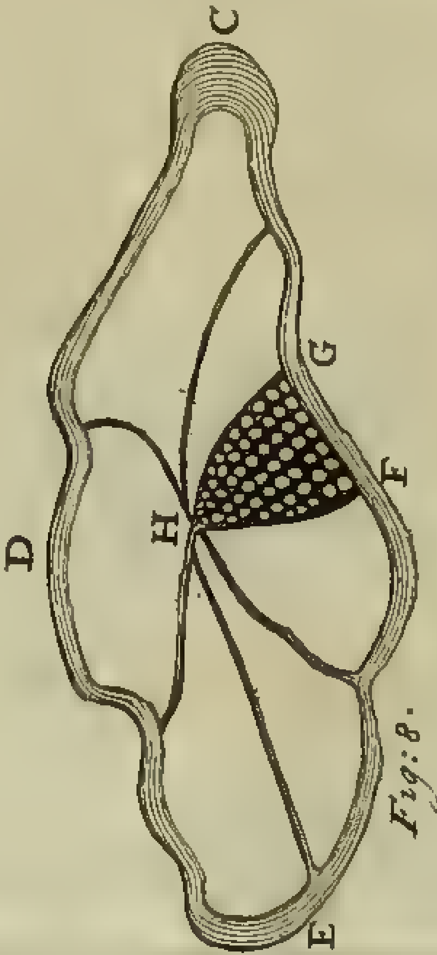

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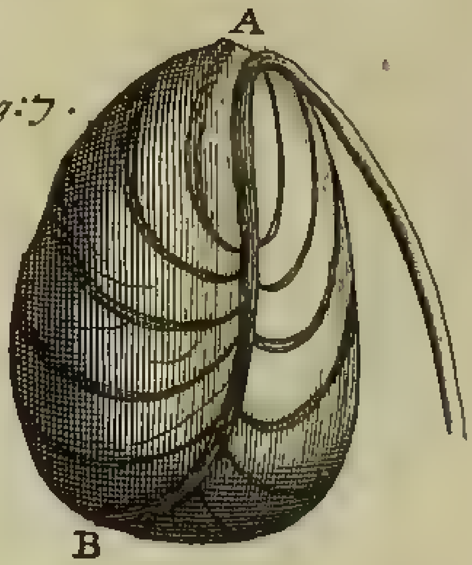

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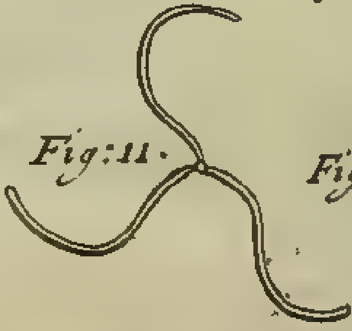

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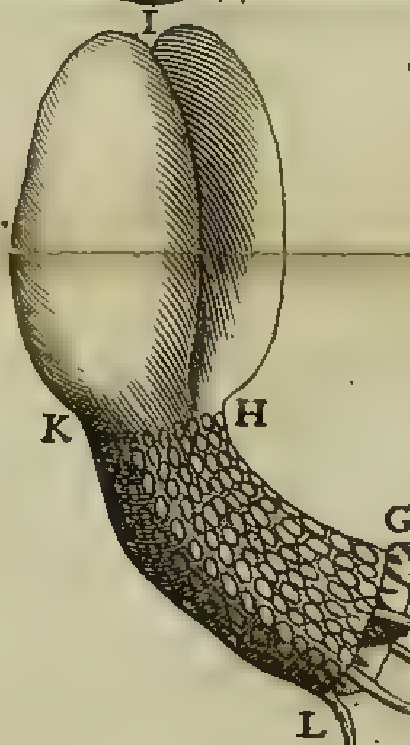

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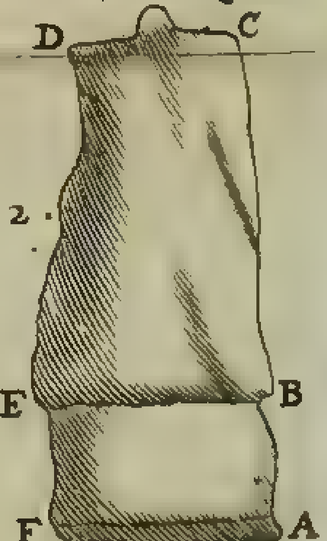

Fig:12.

Numb. 199

PHILOSOPHICAL TRANSACTIONS.

For the Month of April, 1693.

The CONTENTS.

I. *Obſervations on the comparative, intenſive or ſpecific* Gravities *of various* Bodies *made by Mr.* J. C. II. *Extracts of ſome Letters from Mr.* John Sturdie *of* Lancaſhire *concerning* Iron Ore, *and more particularly of the* Hæmatites *wrought into* Iron *at* Milthrop-*Forge in that County, communicated by* Martin Liſter, M. D. *and* S. R. S. III. *The Extract of a Letter from Mr.* Anth. Van. Leeuwenhoek *concerning the* Seeds *of ſome* Plants, *with Obſervations on the manner of the* Propagation *of* Plants *and* Animals. IV. *Part of a Letter from Sir* R. B. *S. R. S. to Dr.* Liſter, *concerning the* Giants Cawſway *in the County of* Antrim *in* Ireland. V. *A Relation of a Storm of* Thunder *and* Lightning, &c. *at* Oundle *in* Northamptonſhire *on the* 20th *of* March *laſt, by Mr.* W. R. VI. *Some* Anatomical Obſervations *in the Heads of ſeveral* Fowl, *made by the late* Allen Moulin, *M D. S R.S.* VII. *An Account of Books.* 1. ΠΥΡΕΤΟΛΟΓΙΑ, ſeu Exercitationes de Morbis Univerſalibus Acutis. Auth. *Ric. Morton* M.D.*&c. Lond. in* 8°. 1692. 2. Catalogus Plantarum Horti Academici *Argentinenſis*, &c. adcurante *Marco Mappo* M. D. &c. Argentorati apud *Frid. Spoor*, 1691. in 12°. 3. Stephani Chauvini Theſaurus Philoſophicus, *&c. in* Fol. 1692.

I. *Obſervations of the Comparative, Intenſive or Specific Gravities of various Bodies. Made by Mr. J. C.*

Pump-water.	1000
Cork.	237
Saſſafras Wood.	482
Juniper Wood (dry.)	556
Plum-tree (dry.)	663
Maſtic.	849
Santalum Citrinum.	809
Santalum album.	1041
Santalum rubrum.	1128
Ebony.	1177
Lignum R~~hodium~~.	1125
Lignum Aſphaltum.	1179
Aloes.	1177
Succinum pellucidum.	1065
Succinum pingue.	1087
Jet.	1238
The top part of a Rhinoceros-horn.	1242
The top part of an Ox-horn	1840
The (Blade) bone of an Ox.	1656
An human Calculus.	1240
Another Calculus humanus.	1433
Another Calculus.	1664
Brimſtone, ſuch as commonly ſold.	1811
Borax.	1720
A ſpotted factitious Marble.	1822
A Gally-Pot.	1928
Oyſter ſhell.	2092
Murex-ſhell.	2590
Lapis manati.	2270
Selenitis.	2322
Wood petrefied in *Lough-Neagh.*	2341
Onyx ſtone.	2510
Turcois-ſtone.	2508
Engliſh Agat.	2512
Grammatias lapis.	2515
A Cornelian.	2568
Corallachates.	2605
Talc.	2657
Coral.	2689
Hyacinth (ſpurious.)	2631
Jaſper (ſpurious.)	2666
A pellucid Pibble.	2641
Rock Cryſtal.	2659
Cryſtallum Diſdiaclaſticum	2704
A red Paſte.	2842
Lapis Nephriticus.	2894
Lapis Amiantus from *Wales*	2913

Lapis

Lapis Lazuli.	3054
An Hone.	3288
Sardachates.	3598
A Granat.	3978
A Golden Marcaſite.	4589
A blew Slate with ſhining Particles.	3500
A mineral ſtone, yielding 1 part in 160 Metal.	2650
The Metal thence extracted.	8500
The (reputed) Silver Ore of *Wales*.	7464
The Metal thence extracted.	11087
Biſmuth.	9859
Spelter.	7065
Spelter Soder.	8362
Iron of a Key.	7643
Steel.	7852
Caſt Braſs.	8100

Wrought Braſs.	8280
Hammer'd Braſs.	8349
A falſe Guinea.	9075
A true Guinea.	18888
Sterling Silver.	10535
A braſs Half-Crown.	9468
Electrum, a Britiſh Coin.	12071
A Gold Coin of *Barbary*.	17548
A Gold Medal from *Morocco*.	18420
A *Mentz* Gold Ducat.	18261
A Gold Coin of *Alexanders*.	18893
A Gold Medal of Q. *Mary*.	19100
A Gold Medal of Q. *Elizabeth*.	19125
A Medal eſteem'd to be near fine Gold.	19636

II. *Extracts of ſome Letters from Mr.* John Sturdie *of* Lancaſhire *concerning* Iron Ore; *and more particularly of the* Hæmatites, *wrought into Iron at* Milthrop-*Forge in that County. Communicated by Dr.* Martin Liſter, S. R. S.

Townley, March 14. 1674.

SIR,

YOU will receive herewith ſome of the Cinder you deſir'd, as alſo a little of Iron-ſtone both burnt and unburnt. They have ſeveral ſorts of Iron-ſtone, and of different Natures; for ſome makes *Coldſhire*-Iron, that is, ſuch as is brittle, when it is cold; another ſort makes *Redſhire*, that is, ſuch as is apt to break if it be hammered, when it is of a dark red Heat, and therefore are never melted down but in mixture, and ſo they yield an indifferent good ſort of Iron. They have of late made it much better than heretofore, by melting the Sow-metal over again, as likewiſe by uſing Turf and Charcoal, whereas formerly their Fuel was only Charcoal. They once made Trial of Pit-Coal, but with bad Succeſs. The ſmall duſty part of their Charcoal is uſeful for burning the Iron-ſtone; for every 17 Baskets of this burnt Stone they put in one of Brimſtone unburnt to make it melt freely, and caſt the Cinder. There is no other Cinder ſwimming above but ſuch like as this I ſend you, only ſometimes it is more vitrified than it is at other times. They always take it off from the melted Iron with a Coal rake at a hole in the Furnace-mouth before they let the Metal run. There is nothing remains in the bottom of the Hearth, all becomes either Iron or Cinder.

The Furnace is built on the ſide of an Hill, the bottom is about two yards ſquare, and ſo riſes perpendicular for a yard or more, which is alſo lined within with a Wall of the beſt Fire-ſtone to keep off the force of the Fire from the Walls of the Furnace: The Bellows (which are very large, and played with Water) enter about the middle of the *Focus*. The reſt of the Furnace is raiſed upon this 6 or 7 yards ſquare-wiſe, but tapering; ſo that the ſides draw towards each other by degrees, and the top-hole (where they throw in Baskets of Stone and Fewel) is but about ½ a yard ſquare. Into this place they put down a Pole, to know how far it hath reſted after a certain time; and when they find it to have ſubſided about a yard and ½, then they put in more, till the Furnace be full again.

*Thurnham, Aug.*12. 1675.

SIR,

THough I am in daily expectation of ſome of the *Miltbrop* Iron-ſtone, and may poſſibly get it before this Letter reach you, yet I thought it not convenient any longer to defer the Account I received thereof from a Gentleman concerned in the Work, for fear ſome of the Circumſtances ſhould ſlip out of my Memory.

The Oar is got in *Fourneſſe* (a diviſion of *Lancaſhire*) at leaſt 15 Miles from *Milthrop.* Some of it is hard, but feels ſoft and ſmooth on the out-ſide like Velvet. Some is ſoft as Clay, but all is red, and lies in Beds like Coal.

The Furnace in which it is melted is not above a yard and ½ over, and about the ſame height. The Hearth is all of Sow-Iron, much of the Shape of a broad-brim'd Hat with the Crown downwards. The Sides are of Stone, arched towards the top; in the midſt is a Tunnel at which they put in Charcoal, on which when it is kindled, they put Oar (firſt broken into pieces as big as a Pigeons Egg) ſo much as they intend to melt down.

Then they ſet their Bellows on work, which are moved with Water, and go into the midſt of the Furnace-Wall, and keep blowing for ſome 12 hours, feeding it ſtill with new Charcoal as it ſettles.

Then they pull out a Stopple at the bottom of the Wall, and out comes all the Glaſſie-Cinder being very liquid, leaving the Iron in a Lump (for it does not flow) in that Conical Hole in the midſt of the Hearth.

This they take out with great Tongs and put under heavy Hammars (played alſo with Water) whereby after ſeveral Heatings (in the ſame Furnace where it is melted) it is beaten into Barrs. They get about an

Hundred weight of Metal at one melting, which is the Product of about three times ſo much Oar.

Thurnham, *Sept.* 25. 1675.

SIR,

I Send now at laſt the promiſed Parcels of Iron Oar, one ſort of it ſeems to be good *Hæmatites*. It ſeems I either did not rightly apprehend, or was not clearly enough informed by the Perſon from whom I had the Account I ſent you, of the Furnace in which they melt down their Oar.

It is very much like a common Black-ſmiths, *viz.* A plain open Hearth or bottom without any encloſing Walls, only where the noſe of the Bellows come in through a Wall there is a hollow place (which they call the Furnace) made of Iron Plates, as is alſo that part of the Hearth next adjoining. This hollow place they fill and up-heap with Charcoal, and lay the Oar (broken ſmall) all round about the Charcoal upon the flat Hearth, to bake it as it were, or neal and thruſt it in by little and little into the Hollow, where it is melted by the Blaſt. The glaſſie *Scoriæ* run very thin, but the Metal is never in a perfect Fuſion, but ſettles as it were in a Clod, that they take it out with Tongs, and turn it under great Hammers, which at the ſame time beat off (eſpecially at firſt taking out of the Furnace) a deal of courſer *Scoriæ*, and form it after ſeveral Heats into Bars. They uſe no Lime-ſtone or other thing to promote the Flux, for that I enquired particularly. As to other matters my former Relation is exact enough.

POSTSCRIPT.

SIR,

AFter the Sealing of my Letter that comes with this, I met with one who hath promiſed to ſend me ſome ſoft Oar, as alſo a little of a Chryſtalline Spar that grows to it, and the reſt that you deſire.

As to your Queries.

Steel is not made from that they call Steel-Oar, but Iron, ſuch as is made from the reſt.

All the Oars that were ſent you lie in one Bed or Seam, but the hard Oars lie uſually next the Rocks on each ſide, and the ſoft Oar in the midſt.

The Rocks between which they lie are a grey Lime-ſtone.

There is no rock underneath (as you ſeem to conceive) for the Oar lies between Rocks on each ſide, or rather in the Clefts of Rocks which they follow, ſtill digging deeper many Fathoms. Sometimes the ſaid Clefts (which are filled with Oar) are an Inch, ſometimes a Foot broad, ſometimes three or four Yards, but ſtill one continued Vein running downwards towards the Center of the Earth.

Thurnham, Nov. 14. 1675.

I ſhall ſhortly meet with one from *Fourneſs*, and ſhall get you a Reſolution of your Queries, as alſo ſome of the Oar you deſire. They uſe it frequently, and with great Succeſs, as a Medicine for the Murrain in Cattle, and for all Diſeaſes in Swine, to which laſt they will give a good handful or two in Milk.

N. B. *This is meant of the ſoft Oar like Clay. I have this to add, that this Clay* Hæmatites *is as good, if not better, than that which is brought from the* Eaſt Indies. *Witneſs the* Tea-Pots *now to be ſold at the Potters in the* Poultrey *in* Cheap-ſide, *which not only for Art, but for beautiful Colour too, are far beyond any we have from* China. *Theſe are made of the* Engliſh Hæmatites *in* Staffordſhire, *as I take it, by two* Dutch-men, *incomparable Artiſts.*

Weſtm. *May* 1. 93. I am, &c. *M. L.*

III. *A Letter from Mr.* Anth. Van Leeuwenhoek *concerning the Seeds of Plants, with Obſervations on the manner of the* Propagation *of* Plants *and* Animals.

IN the Seed of an *Aſh* repreſented of the natural Size by *Fig.* 1. I obſerved not only two large Leaves, but that part alſo whence the Root takes its Riſe, was extraordinary big; this part of the Seed I always found uppermoſt when growing on the Tree, ſo that the Seeds have a contrary Situation on the Tree to what they have in the Earth. Theſe two Leaves of the Seed or Lobes were filled up with an innumerable quantity of very ſmall Globules, except where the Fibres were viſible: Which likewiſe were compoſed of much ſmaller Globules, and took their Origine from that part whence the Root proceeds. This ſuppoſed Root I cut through the middle, and have repreſented it *Fig.* 2. wherein the outward Ring repreſents the Bark, the next repreſents the woody part full of dark-coloured Pricks, which are the Fibres thereof. The innermoſt Oval repreſents the Pith, compoſed of round Bodies. I have likewiſe found that the bigneſs of the Seeds of Plants does no way anſwer to the Size of the Leaves of the Plant, there being very ſmall Rudiments of the Leaves and Plant in the large Seeds of the Oak and Peach repreſented by *Fig.* 3. and on the contrary, very conſiderable ones in the Seeds of the Aſh.

As I have formerly obſerved in the fleſhy *Fibres* of the *Muſcles*, that there were no Blood-Veſſels intermixt with them, but they were placed only in the Membranes that encompaſſed the Muſcles, and ſhew'd how the fleſhy Muſcles might be nouriſh'd by theſe Blood-Veſſels, ſo I find the Leaves of Plants to be made up of Globules included in the Membrane that makes the Superficies of the Leaf in all places but where the Fibres are conſpicuous. The manner how I ſuppoſe theſe Globules, and by conſequence the Leaf is nouriſh'd is thus: The Liquor or Sap is conveyed in the Veſſel *B C*, *Fig.* 4. and is communicated firſt to the Globule *F*, from that to *G*, thence to *H*, and ſo on; as if you ſhould put ſeveral ſmall Pellets of dry'd Clay in a glaſs Veſſel, if the Water touch but one of them, you will find it communicated by that to the Second, Third, and ſo on till they are all Wet.

I could not find any thing to ſatisfie my Curioſity in the ſmall Seeds of *Figs* and *Strawberries*; poſſibly they were not ripe enough; for I doubt not but that they have the ſame parts that larger Seeds have.

And if in the ſmall Seeds of the *Aſh* (6 whereof weigh not 4 Grains) there are to be ſeen not only perfect Leaves with their Veſſels, but the woody part alſo, and that from whence the Root ſhoots out (nay plainer than in the Wallnut or Hazel) we may well conclude that wiſe *Nature* proceeds after the ſame manner in all its Operations of Generation and Propagation; every Seed containing not only the Rudiments of the future Plant, but alſo a certain fine Flower to nouriſh it ſo long, till ſtriking Root into the Earth, it may thence receive its Nutriment. This Flower is of an oily Nature, and the more oily the longer will the Seeds live out of the ground. And as Plants are not *Male* and *Female*, nor have a *Matrix* for the firſt Reception and Suſtentation of the Young, ſo the Parent Tree produces a perfect Plant wrapt up in the Seed which the Earth receives and nouriſhes. I have likewiſe found that of ſuch Trees as are reckon'd *Male* and *Female*, very few that bore Seeds the laſt year have bore any this year; ſo that I queſtion whether the Trees which we find without Seeds may be therefore called *Male* Trees.

I think it now paſt all doubt, that the *Generation* of *Animals* is from an *Animalcule* in the *Male Sperm*: And tho I have often fancied that I have diſcovered the Parts and Membranes of the *Fœtus* in this *Animalcule*, ſo as to ſay there is the Head, there the Shoulders, and there the Thighs, yet I will affirm nothing herein, till I ſhall be ſo lucky as to find an *Animalcule* large enough to diſcover this Truth, which I am not quite in deſpair of, ſince I have been ſo fortunate as to meet with in the ſmall Seeds of the Aſh, Leaves and Rudiments of the future Plant far larger than in the Seed of any Plant I have yet examined.

But to examine the matter a little cloſer: *Nature* proceeds almoſt after the ſame Method in her Operations as to the Production of *Plants* and *Animals*: For as the *Animalcule* of the Male *Sperm* cannot live in the *Matrix*, without being wrapt up in the ſeveral Coverings, and receiving its Nouriſhment; ſo neither can the Seed of the Plant ſubſiſt without continual nouriſhment, and has alſo its Coats to encompaſs it: And which is obſervable, as the *Fœtus* has but one ligament conſiſting of ſeveral Veſſels, by which it is faſtned and nouriſh'd, ſo all the Seeds which I have ſeen have but one Ligament, made up of ſeveral Veſſels alſo, which is ſometimes longer, ſometimes ſhorter. I will preſent the Reader with the Draughts of ſome Seeds. *Fig.* 5. *A B C* is the outward Membrane of the Seed of an *Aſh*, *A D* the place where the Seed it ſelf lies, which is taken out and repreſented by *E F*. *A F* is the Ligament by which the Seed *E F* receives its Nouriſhment, the part *A* being only joyned to the Tree; and what is more obſervable, the point of the Seed *F* where the Ligament is faſtned, is likewiſe the place whence the Root proceeds: So that the Root is the laſt that parts from the Tree, which at firſt, while the Seed is young, is upwards; but afterwards the Seed and Fruit growing heavier, it bends the Stalk, and turns downwards to the Earth. The ſame thing is in Apples, Pears, &c. Theſe Ligaments by which the Seeds are nouriſh'd have their Coats or Bark within which, as I gueſs, are more than 100 ſmall Veſſels, in the Filberd, all wreathed and twiſted up after a Spiral manner, as in *Fig.* 6. It is obſervable, that this *Ligament* is faſtned (in almoſt all Seeds) to that part whence the *Embrio* Plant ariſes, as in *Fig.* 7. which repreſents a *Filberd* larger than the Life, that the Veſſels proceeding from the Ligament may be more viſible. Where the *Ligament* goes from *A* to *B* branching all the way into Ramifications, and they again into leſſer, all which meet again at the place whence they began, that is, where the Plant is to have it's beginning.

In the 8*th Fig.* I have ſhewn the *Ligament* of an *Almond*, which being naturally pretty large, I the rather pitch'd upon it. It is cut tranſverſe. *C D E F G* is the *Cortical* part thereof; it is divided into 7 Partitions meeting at *H*, each whereof is of a reddiſh Subſtance; the Veſſels to be ſeen in one of the ſpaces are repreſented by *F G H*, from the View whereof may be collected the great number of Veſſels in the whole *Ligament*, by means whereof the Seeds of the *Almond* and *Filberd* are nouriſh'd: For I could find no difference in the Ligaments of theſe two Seeds, only in the Almond all the parts were larger.

If we conſider the Propagation of *Animals*, and that they are ſo long nouriſh'd in the *Uterus* by means of the *Umbilical* Veſſels, till they are fit for a more open Life, and are then no longer kept Priſoners. And again, that the *Embrio* which is to be the future Plant, perhaps a Tree is ſo long contained in that Body which we call the Seed, and fed by means of a *Ligament* from its *Matrix*, to wit, the Tree, till it be of a competent growth, and has a ſufficiency to provide for it ſelf, and grow when expoſed on the bare ground, and then it is no longer kept up. I ſay, if we conſider theſe two Methods of *Nature*, we ſhall not find any other difference between *Plants* and *Animals*, than that the firſt wanting a locomotive Power, cannot couple as Animals do, and therefore muſt contain in the ſame Individual, not only the Origine of the future Plants which I compared to the *Animalcule* in the Male *Sperm*, but alſo the maternal Nouriſhment ſufficient for it till it is furniſh'd with a Root to provide for it ſelf. This Nouriſhment is a ſort of Flour which encompaſſes the *Embrio* Plant, and in the Seed makes the two Lobes.

If we compare *Plants* with *Birds*, we ſhall find that as in Birds which are Male and Female, it is neceſſary for the *Animalcule* of the Male already endowed with a living Soul to be placed near the Yelk of the Egg of the Female, to be thence ſo long nouriſh'd till it is fit to receive its Food from the Mother, or gather it off the Ground : So in Plants the *Embrio* is placed next to a ſort of Fine Flour which I compare to the Yelk of the Egg, which not only defends the young Plant, but likewiſe affords it its firſt *Aliment*.

We may likewiſe compare the Propagation of *Trees* with *Fiſh*, and find the ſame Agreement. In fine, the Egg in Animals ſeems to be for the ſame uſe as the Lobes of the Seed in Plants.

Although I have formerly aſſerted, that the *Female* ſerved only to afford nouriſhment to the *Animalcules* of the *Male Sperm*, and that Plants grow out of the ſubſtance wherewith they are watered ; yet I acknowledge for a certain Truth, that a great *Variety* is cauſed in *Animals* by the Nouriſhment received from the Mother. So by a Horſe and She-Aſſe a *Mule* is generated, which is like neither, but participates of both, differing from the Horſe, eſpecially in the Ears and Tail ; ſince the Aſs abounding in that nouriſhment which produces the Ears, and wanting that which gives a long Tail, it muſt neceſſarily be like the Mother in thoſe two particulars. So from a *White* Man and *Negro* Woman a *Meſtico* is born: And from a large Pigeon or *Cropper* and a ſmall wild Hen Pigeon, the Young are like neither; the Egg of the Female is not ſufficient to nouriſh the *Animalcule* of the Male, ſo as to give it the Size of its Father. And thus Plants receive a great alteration from the different Soils in which the Seeds are planted. So *Apples* brought from *France* are with us in great eſteem; and what care ſoever we take in the Trees themſelves, yet they ſoon degenerate in our Soil; which change proceeds from the different Salts they meet with in the ground. And I believe if we could take the *Embrio* Plant out of one Seed and put it into another, ſo as it would grow, we ſhould have a new Plant from thence like to neither: As if we ſhould take the *Embrio* out of the Wallnut (which I will liken to the *Animalcule* of the *Horſe*) and ſo join it to the Seed of the *Cheſtnut* (which I compare to the *Matrix* of the *Aſſe*) that it would grow, the Plant produced by this Union would be a new and unknown Tree.

Willows are uſually planted by thruſting a Stake into the Ground in wet places, yet finding ſeveral young ones on the Banks of Rivers, I judged theſe grew from the Seed. Wherefore in the beginning of *June*, examining the downy Seeds of theſe Plants, I found ſeveral browniſh Particles, not much bigger than Sand; which the Microſcope diſcover'd to be the Seeds thereof, which are contained in ſeveral little Violet-colour'd Boxes, of which in a little Sprig there were 75 placed by one another, each containing 3, 4, or 5 ſmall Seeds, encompaſſed with a pappous Down. *Fig.* 9. repreſents theſe Seeds of the natural bigneſs. The Down or Pappous part is joined by one common Knot or Center firſt, and ſo to the Seed, and conſiſts of 2, 3, 4, 5 or 6 ſmall Threds, which ſo ſoon as the *Capſula* breaks upon the ripening of the Seed, ſpreads its ſelf every way, as *Fig.* 10. tho' before the Threds were cloſed up in one, as *Fig.* 11. by which means it eaſily carries the ſmall Seeds on the Wings of the Wind to great diſtances. Viewing theſe Seeds more nicely, I ſaw that part whence the Root has its beginning (which makes one third part of the Seed) furniſht with very many Veſſels, conſiſting only of oblong and round Particles. The reſt of the Seed conſiſted of two Lobes of a dark herby Colour made up of Globules, and between theſe, two very ſmall Points riſing up, which were the beginnings of the Leaves of the Tree or *Embrio* Plant, which the Lobes themſelves were to nouriſh till it ſhould be furniſh'd with a Root to provide for it ſelf.

I took ſome of theſe very ſmall Seeds, and ſowed them in wet Sand in my Cloſet in *June*, the better to diſcover the manner of their growth These Seeds being very much dried, and thereby ſhrunken, appeared thro' the Microſcope, as *Fig.* 12. though they were not all alike, ſome being more, ſome leſs dried up. *A B E F* is that part whence the Root ſhoots forth. When they had lain in the wet Sand 36 hours, they ſhewed as *Fig.* 13. the Proportion of the part *G H K L* being then conſiderable, and in ſo ſhort a time 6 Roots were ſhot out from it, and the two Lobes *H I K* began to ſhew themſelves. In 72 Hours the Roots began to divide and ramify, and to take hold on the Sand. That which is obſervable in this Tree is, that the Seeds come to their perfect maturity before the Leaves of the Tree have their full growth, whereas other Trees perfect not their Seeds till after the Fruit in *Autumn*; ſo that this Tree has its young Plant grown up the firſt Year. The ſame is obſervable in the *Elm*; ſome of the Seeds whereof I gather'd in *May*, dry'd and ſow'd them, and in three days they ſprung up. I try'd the ſame in the downy Seeds of the *Poplar* and *Indian Cotton.* If theſe diſtinctions of parts are ſo ſoon viſible in theſe ſmall Seeds, why ſhould we doubt the production of an *Animal* from the ſo often named *Animalcules.* Indeed we muſt own our ſelves at a ſtand, when we would find out how theſe *Animalcules* receive Life, and that not before the *Male* has attained a certain Age; and the rather, ſince we hold that the matter whence theſe *Animalcules* proceed, was likewiſe in that *Animalcule* it ſelf when it was firſt committed to the *Matrix.* And indeed that very extraordinary minuteneſs, by which one Creature is tranſmitted to another, is incomprehenſible.

Nor can we be better ſatisfied as to this matter in Trees than Men; for we ſee plainly, that very many Trees growing from Seed are ſome years before they bring forth Fruit and Seeds, at leaſt ſuch Seeds as will produce another Plant. So that we cannot ſay, that that Seed which will produce a Tree depends only on the Tree; but that the ſubſtance of the Seed, by means whereof a Tree is propagated, depends on that Seed from whence the Tree it ſelf alſo proceeded. And tho' we may after ſome manner imagine how the Fruit, as an Apple or Pear, conſiſting of ſeveral round Particles (to omit the Veſſels) may be produced, ſince there are 8 or 10, it may be more Ligaments (each whereof has a multitude of Veſſels) which may tranſmit ſeveral Juices; yet how can we conceive that the Origine of a Plant can be thus formed. So that we ſee the beginning of the Propagation of the Tree is to us incomprehenſible, although we ſee it done before our Eyes; and we may ſuppoſe it after the ſame way as it is in Man. To conclude, the Tree after 8 or 10 years begins to bear Seed, which depends not only on the Tree, but on the former Seed: So it is in the *Male Sperme*, which has its Original not only from the *Male*, but from the *Animalcule* from whence the Male its ſelf was produced. So that the firſt eſſential beginnings of things which are incomprehenſibly ſmall, will be always hidden from us.

IV. *Part of a Letter from Sir* R. B. *S.R.S. to Dr.* Liſter, *concerning the* Giants Cauſway *in the County of* Atrim *iu* Ireland.

Old Bawn, Apr. 24. 1693.

—— —— —— ——Concerning the Giants Cauſey. Prolixity in a Philoſophical Deſcription I'm ſure you'l pardon; for I was very exact in getting it from a perſon that was *rei compos*, perhaps *peritus*; a Scholar (a Maſter of Arts in *Cambridge*) and a Traveller, who went on purpoſe the laſt Summer with the preſent Biſhop of *Derry* to ſee it. It is in the County of *Antrim*, about 7 Miles Eaſt of *Colrain*, and 31 Miles to the Eaſt of the mouth of the River of *Derry*. The Coaſt there is a very great height from the Sea, but riſing gradually on the Land ſide to the edge of the Precipice, it is all cover'd with an excellent ſweet Graſs; when you come to the Precipice, there is no going down there it is ſo perpendicularly ſteep, but with much Labour and ſome Hazard it may be climb'd up. By other ways and windings one comes down to the *Strand*; in which, from the foot of this Precipice, there runs out Northward, into the Main Ocean, a raiſed Cauſway of about 80 foot broad, and about 20 foot high above the reſt of the *Strand*; its ſides are perpendicular, it went on above two hundred foot to the Sea-Water; that is, it was ſo far in view; but as he was there told, it did not advance much farther, under the Superficies of the Water. This whole Cauſway conſiſts all of Pillars of perpendicular Cylinders, Hexagones and Pentagones, of about 18 and 20 Inches Diameter, but ſo juſtly ſhot one by another, that not any thing thicker than a Knife will enter between the ſides of the Pillars. The Pillars do not conſiſt of Joints, as you were informed, but each Cylinder is one ſolid piece, only indeed in breaking it breaks croſs-wiſe or Horizontally, and not length-wiſe, which we commonly call ſplitting ; and it is by its thus breaking, that the Texture of the middle of the Cauſ-way is diſcovered ; for pieces have been broken from many of the Cylinders that are in the middle, (pieces of unequal lengths) whereby one ſees (ſo deep) the perpendicular ſides and edges of the circumjacent Cylinders. [Pardon the Impropriety of the Word.]

That the Cylinders do not conſiſt of Joints, is manifeſt from this, that the pieces ſo broken off, have their bottoms as often convex or concave as flat and even ; and many ſuch pieces there are lying looſe upon the Sand of the Shore, which the Sea has waſhed down from it. When one walks upon the Sand below it, the ſide of this Cauſ-way has its Face all in Angles, the ſeveral Cylinders having ſome two, ſome three of their ſides open to view. This Gentleman, tho' he had no Notion of *Aſtroites*, yet believes them all to be natural, becauſe there is no other ſort of Stone or Rock there : Nay, that very vaſt high Precipice does conſiſt all of Cylinders ; tho' ſome ſhorter and ſome longer (whereby you may now underſtand it not impoſſible to climb it up, as by ſteps, tho' irregular ones) and all the Stones that one ſees on that Coaſt, whether ſingle or in Cluſters, or that riſe up any where out of the Sand, are all Cylinders, tho of never ſo different Angles ; for there are alſo four-ſquared upon the ſame Shore. This Cauſway runs out into the Northern

Ocean, having no Land over againſt it any where. This is all I can now tell you of it, and from this imperfect Deſcription you may form what Queries you think fit. I dare not promiſe you that I ſhall go to ſee it this Summer (it being full Sevenſcore Miles off) tho' I have a great Temptation as well as Deſire ſo to do; but if I do not, I can get your Queries wel anſwered upon the place.

V. *The Relation of a Storm of* Thunder, Lightning *and* Hail *at* Oundle *in* Northamptonſhire *on the* 20th *of* March 169$\frac{2}{3}$. *By Mr.* W. R.

THE Day on which the Storm happened was the 20*th* of *March*; the Day was ſtormy, as the Weather had been ſome time before; but about eight at Night there aroſe a very violent Guſt of Wind, at *South-Weſt*, which laſted an hour and half, till the *Thunder-clap* was over, during which time it rained very faſt. A quarter of an hour, or thereabouts, after Nine, fell a mighty Storm of *Hail* intermixed with *Rain*, which lay very white, and ſome depth on the ground, and to me appeared to have Snow mixed with it. During that *Storm* happened the *Lightnings*, which were but two Flaſhes, but very violent and ſtrange; it had hailed near a quarter of an hour before the Lightning; it was extraordinary blew, and of a Sulphureous Smell. It ſeemed to ſtand ſtill in the Houſe ſome conſiderable time, and was ſo great, that a Gentleman who ſat below ſtairs, thought that the Houſe had been on Fire above, and that the Flames rolled down Stairs. The Clap of *Thunder* which immediately followed ſeemed to all like the ſuddain Diſcharge of five or ſix Field-pieces, not with that rolling, deep noiſe *Thunder* uſually carries along with it: Indeed, for my part, I thought it had been Guns. The Second Flaſh and Clap followed within a few Minutes of the firſt, but not with that Violence as the former: Which Flaſh fir'd the *Steeple* I cannot ſay, but a piece of Wood to which the Lead of the Windows was nailed (the Windows being nothing but Lead cut full of Holes) was ſet on fire, and kindled very faſt, and might have done a great deal of Miſchief, had not the earlineſs of the Night, and timely help prevented it. This Storm ſeemed to run in a direct Courſe; for ſeveral of our ſide-Towns perceived little of it; and I believe it broke chiefly over us, for I hear of no Effects it had any where elſe, but only at *Kettering*, where one of their Bells, as ſome ſay, received ſome damage, and the Wires of the Chimes were twiſted one within another: The Wind was very bluſtering all the Night after.

Oundle, Apr. 22.
1693.

Yours, &c.

VI. *Anatomical Obſervations in the Heads of Fowl made at ſeveral times. By the late* Allen Moulen, M. D. *S.R.S. Read before the Royal Society*, Feb. 1. 168⅞.

1. IN the Heads of all the Fowl that I had an opportunity to examine, I conſtantly found only one *Aquæductus*, or Paſſage from the Ears into the Pallat;

whereas in Men, Quadrupedes, and ſome Amphibious Fiſh, there are always two, one on each ſide below the entrance of the Noſtrils into the Pallat, and opening towards the Noſtrils, for the more convenient reception of Air, as is ſuppoſed. This Paſſage in Fowl is exactly in the middle of the Pallat, below the entrance of the Noſtrils into it: It is a membranous Tube, capable of admitting a Ravens, if not a Gooſe Quill in larger Fowl, ſuch as Turkeys, Geeſe, *&c.* and reaches backward as far as the Communication from Ear to Ear, and hence it comes to ſerve both; whereas there is a neceſſity of two in thoſe Animals, whoſe Ears do not communicate.

2. I have purpoſely examined the Heads of all the Species of Fowl I could procure, and conſtantly found a hollow ſpace between the two Tables between the *Os Cuneiforme* reaching from Ear to Ear, and as far forward as the aforeſaid common *Aquæductus*, or rather ***Ductus Aereus***, the contrivance of it ſeeming more to favour this than the former uſe. This Cavity in all Fowl (as far as I have obſerv'd) reaches above the *Labyrinthus* on each ſide, ſo that whatever impulſe is made on the *Tympanum* on the one ſide, may not only be very readily communicated by means of the internal Air to the *Labyrinthus* of the ſame, but alſo to that of the oppoſite ſide. Hence probably proceeds the quickneſs of Hearing and Vigilancy of Fowl, notwithſtanding their wanting a *Cochlea*, the defect of which ſeems to be by this Structure more than ſupplied, no other Creatures that we know of having any thing of it. It is not improbable that the oppoſite Ear to a Sound is altogether as much affected by it as that next it, if not more. There are ſeveral *Laminulæ* and Pillars of hard Bone between the two Tables in theſe Caveties, deſigned, as may be ſuppoſed, partly for their Maintenance at a convenient diſtance, and partly for breaking of the Air, ſo as to hinder Ec-

choes and confus'd repreſentations of Objects. In confirmation of which laſt Reaſon Sir *John Hoskins* did ingeniouſly obſerve, that Pillars in Churches very much prevented Ecchoes: And for the ſame reaſon theſe might alſo hinder them in the Heads of this particular Structure.

3. In the Heads of *Woodcocks*, beſides the paſſages now deſcrib'd, I found one on each ſide the Bone, making the Orbit of the Eye proceeding from the Ear, and reaching forward towards the ſetting on of the Beak, near which they join'd in one, and turn'd under the Skull in a ſmall paſſage leading to the Cavity, by which the Ears communicate, and which is above deſcrib'd, into which it enters. Theſe paſſages are alſo in the Heads of *Snites*; and moreover, one over the *Sinus Longitudinalis*, and another over the *Sinus Lateralis* of the Brain. Note, that in the killing of *Snites* and ſmaller Birds, if care be not taken that the Head be not bruis'd, theſe paſſages cannot be diſcover'd for Blood extravaſated in them. Note alſo, that the *Laminulæ* and bony Pillars are every where to be obſerv'd where there is a paſſage, excepting under the Skull, in the paſſage from the ſetting of the Bill to the firſt paſſage deſcrib'd.

4. In the Heads of *Parrots* and *Paroquets*, beſides the firſt deſcrib'd paſſage, I obſerv'd between the two Tables every where Cells opening into others, and thoſe into others, ſo that there was not any part ſcarcely of the Skull that was not taken up with them. And this did not only appear by pouring into one Ear freed from its Drum, the other alſo being removed, a Tincture of Cochinel, and then blowing of it into all theſe Cells, ſo that no part was free from Tincture; but it appeared alſo to the naked Eye, notwithſtanding that ſometimes it was difficult to trace the Communications of them by reaſon of numerouſneſs of the *Laminulæ* and Pillars aforeſaid.

5. In Singing Birds the Sructure of theſe paſſages is like that of the *Parrot* and *Paroquett*, only that the Pillars and *Laminulæ* are leſs than they ſhould ſeem to be in proportion to the Heads. From whence it is probable, that theſe Birds are by this Structure enabled to diſtinguiſh Sounds and Notes, and alſo imitate them better, having a more muſical Ear.

6. In the Heads of *Pullets*, *Geeſe* and *Ducks* I found only the firſt deſcrib'd paſſage diſtinctly, but in *Pluvers*, *Buſtards*, and ſome other, I found another that went over the *Sinus Lateralis* of the Brain from Ear to Ear. This ſeems to be deſign'd to make them more watchful than Domeſtick Fowl, or yet thoſe that live much on the Water, becauſe they are liable to a great many Dangers that the others are exempt from. Note, that there are for the moſt part great varieties in the Structures of all Fowls Heads.

7. In the Ears of all the Fowl that I could examine, I never found any more than one Bone and a Cartilage, making a Joint with it that was eaſily moveable. The Cartilage had generally an Epiphiſe or two, one on each ſide, which were very flexible, as it ſelf was. The Bone was ſmall and very hard, having at the end of it a broad Plate of the ſame Subſtance very thin, upon which it reſted as on its *Baſis*. I got that of a Pullets Ear, repreſented in *Fig*. 4. where *a* is the main *Cartilage*, and *b b* the two *Epiphyſes*, *c* the ſmall Bone, and *d* the *Baſis* or broad end of it. Note, that in the Figure, part of the Drum ſticking to it is repreſented together with the Cartilages.

8. I obſerv'd three pair of *Nerves* in all the broad bill'd Birds that I could meet with, and in all ſuch as feel for their Food out of their ſight, as *Snites*, *Woodcocks*, *Curlews*, *Geeſe*, *Ducks*, *Teale*, *Widgeon*, &c. Theſe *Nerves* are very large, equalling almoſt the *Optick Nerve* in thickneſs; they begin a little more forward than the

Auditory Nerve from a little Protuberance which ſeems to be made for them: One of them goes over the *Optick Nerve* in the Orbit of the Eye, the other two go under the Eye. Two are diſtributed nigh the end of the upper Bill, and are there very much expanded, paſſing through the Bone into the Membrane, lineing the Roof of the Mouth. The third Pair is diſtributed near the end of the lower Bill, and ſubdivided like the former. Note, that Birds that pick their Food where they can ſee it have not theſe *Nerves*, and that the Pair of Nerves belonging to the upper Bill is conſiderably ſmaller in proportion to the Fowls than thoſe obſerv'd above; whence it is probable that theſe *Nerves* were deſigned for ſome great uſe, both on the account of their number and their largeneſs; and that the uſe to be aſſign'd to them muſt be to enable them to diſtinguiſh (whether by taſting or feeling I will not now diſtinguiſh) their Food, there being a neceſſity of a more exquiſite Senſe in theſe Fowl, than in any other. *Fig.* 15. repreſents theſe in a Ducks Head, where *a a* expreſſes the Edge of the *Cranium*, which was in part remov'd for the more clear view of theſe Nerves, *b b* are the *Cells* about the Ear between the two Tables above deſcribed, *c c* the *Brain* laid bare with its Blood-Veſſels, *d d d* the three *Nerves* on one ſide, *e* the Optick Nerve, *f f f* the Skin and part of the Bone remov'd to bring the Nerve in view, *g g* the two Nerves expanded near the end of the upper Bill, *h h* that in the lower.

9. All the *Eyes* of Fowl and of *Fiſh* that I have examined were more or leſs *cartilaginous*; for the *Sclerotis* is a *Cartilago ſui generis*, eſpecially near the *Cornea* in all theſe Animals. And in the larger ſorts of both I remembred to have found the whole *Sclerotis* ſuch a kind of a *Cartilage*.

10. In the Eyes of Fiſh I obſerv'd that the *Proceſſus Ciliaris* is not faſtned to the joining of the *Cornea* & *Sclerotis*, as in all other Animals that I diſſected, ſo as to hinder the watery Humour to go any further backward. For I conſtantly obſerv'd that the *Humor Aqueus* may move a good way backward in ſome, and in others almoſt as far as the *Optick Nerve.* I ſhall at another time make ſome Remarks on this.

11. I have in as many *Fiſh* as I could conveniently examine carefully, found a Membrane which cover'd the *Tunica Cornea*, ſo as not to let any Water come to it. This anſwers the *Membrana Nictitans* in Fowl, and reaches on all ſides to the *Cutis* of the Fiſh to which it is faſtned; this is tranſparent, and pretty thin, and ſo is alſo the *Cornea,* if compar'd to that of the Quadrupeds.

12. I have frequently obſerv'd in ſmaller Fowl, that the Membrane of the *Drum* was double; for I have by gently pulling away the Membrane lining the Tube of the *Ear*, I obſerv'd at the bottom of it a tranſparent Membrane, which at firſt I took to be the Membrane of the Drum, but upon Examination I found that the Membrane of the Drum was ſtill entire and in its proper place. I have ſometimes obſerved this in larger *Fowl*, in a *Seal*, and in ſome other Animals, and am apt to think from a caſe mentioned in *Du Verneyes* Book of the Ear, that it is ſo in Men; and if ſo, it is likely it may be ſo in moſt, if not in all Animals. The Obſervation was as followeth; A Perſon that was deaf for ſome time died, whoſe Ears Mr. *Du Verneye* examin'd, in order to find out the cauſe of his Deafneſs, which he found to be a thick Membrane growing in the Ear before the *Drum*, which hindred the Impulſes in the Air to be communicated to it. Now I take it to be more likely that the Membrane ſhould be double, and that the outward was preternaturally incraſſated, then that a Membrane ſhould grow in a place where the ſides do not touch.

VII. An Account of BOOKS.

ΠΥΡΕΤΟΛΟΓΙΑ: *Seu Exercitationes de Morbis Univerſalibus Acutis Authore Richardo Morton* Med. D. *Regii Collegii Medic.* **Lond.** *Socio & Cenſore.* **Lond.** *in* 8°. 1692.

THE Doctor knowing well, that Indications in the Cure of Diſeaſes cannot but be uncertain, if they are not founded upon an accurate Knowledge of their true Cauſe, which (at leaſt in the univerſal Diſeaſes) cannot be clearly diſcerned, unleſs the Origination, Situation, Structure and mutual Connexion of the Parts affected be alſo underſtood, ſhews in his Præliminary Diſcourſe, that the Brain is the part which is firſt formed in the whole Body; then gives an account of its Subſtance, and how all the parts, whether Membranes, Muſcles, Veſſels, Viſcera, Tendons, Cartilages or Bones are derived from it, and are Continuations of it, and are actuated and enabled to perform all their ſeveral Functions by Animal Spirits which they receive from thence. From whence he is induc'd to believe, that not only Cephalick Diſeaſes, but all univerſal Diſtempers Acute or Chronic, are primarily occaſion'd by theſe Animal Spirits when they are diſorder'd, and their Oeconomy perverted by an extraneous and diſagreeable Ferment, by which the Blood and the reſt of the Humours are afterwards corrupted; and that therefore in the Cure of Univerſal Diſeaſes, the principal Indications ought to be taken from the Diſorders of the Spirits, and not from the Corruption of the Humours; tho he denies not that the Indications ariſing from the Corruption of the Humours may alſo have their uſe.

In order to eſtabliſh his Hypotheſis, he demonſtrates the following *Lemma's*, That there are really ſuch things as Animal Spirits, where he enumerates all their known Properties: That ſome of theſe Spirits are contain'd in every minute Fibre: That they flow from the Brain as Rays from the Sun, and that the Brain is as it were their great Ciſtern, and the Nerves the Pipes by which they are convey'd to the other parts: That they are the firſt Principle of Action, and do in divers manners agitate and operate upon the Humours: That they are intimately united to the Blood; and here he takes occaſion to prove by many Arguments, That the Blood in its Circulation paſſes through the Habit of the Body between the Extremities of the Arteries and Capillary Veins: That theſe Spirits may be ſeveral ways vitiated, without any antecedent Corruption of the Humours; and tho the Blood out of which the Spirits are made ſhould be antecedently corrupted, yet the univerſal Diſeaſe can't be ſaid to be begun till the Spirits are infected: That the Blood and Humours are alter'd and corrupted by the Diſeaſes of the Spirits, which he proves by ſeveral remarkable Inſtances, and ſhews how a Diſtemper in a particular part, as Conſumption, &c. becomes an univerſal Diſeaſe. Then he proves by many cogent Arguments, that all univerſal Diſeaſes, whether primarily ſuch, or occaſion'd by the diſaffection of a particular part, do immediately ariſe from the Spirits, and that the Sympathy of one part with another, and the Tranſlation of a Diſeaſe from one part to another can't otherwiſe be explained, and that ſome peculiar Dyſcraſy's of the Spirits are the Cauſes of the Diſtempers even of particular parts, and that the Specifics us'd in their Cure have not reſpect to the part affected, but to the particular Dyſcraſy of the Spirits.

After a ſhort Account of Univerſal Diſeaſes in general, he treats of the Nature of Acute Fevers, and calls the Ferment which occaſions them a Poyſon, which he proves to be of a very ſubtile Texture, tho we can't have any perception of it by any of our Senſes; and therefore he forbears to give any particular Deſcription of it, but goes on, and ſhews how clearly the Symptoms of Acute Fevers (which all proceed either from the oppreſſion of the Spirits, or a greater degree of Elaſticity which They acquire from the Imitation of the Poyſon) may be explain'd by his Hypotheſis. Accordingly, he tells us how it comes to paſs, that Coldneſs of the external Parts, a quick and weak Pulſe, and irregular Reſpiration accompany the firſt Inſults of Fevers, and that he once at leaſt hath known the Blood Actually cold in the beginning of the Diſtemper. He alſo gives the Reaſon of the Drowſineſs, Laſſitude, Shaking, Trembling, Toſſing, Yauning, Giddineſs, Sickneſs at Stomach which accompany the firſt Stage, and why a new Fit of Cold and Shaking (if the Fever be not intermitting) ſhould portend ſo much Danger as it doth. Then lays down the Indications which ariſe from theſe Symptoms, and treats of all the other Stages of the Diſtemper in the ſame manner. He takes notice how it comes to paſs that Rheumatical Pains remove from place to place; and omits not thoſe Symptoms which are in the Humours, namely, the Symptom of *Cholera Morbus*, *Diarrhœa*, Vomiting, Thirſt, Dryneſs of the Skin, Redneſs and Thickneſs of Urine, *&c.* Now the Cauſe of this Fever being a Poyſon from whence all theſe Symptoms have their Original, it ought to be cur'd by its proper Antidote. He informs us alſo what is to be done when the Antidote will not take place; and when he diſcourſes of the Criſis of theſe Fevers, he obſerves that Sweats are not the Criſis its ſelf, but a ſign of the Criſis, and gives the reaſon why immoderate Heat is a great hindrance of Sweating as well as Cold.

He ſays but little of the ***Febris Ephemera***, which is the only Fever which ariſes from an evident Cauſe alone, as Motion, Heat, Intemperance, *&c.* This may degenerate into an Intermitting or Malignant Fever, and hath no Pathognomonic Sign by which it is diſtinguiſh'd from other Fevers beſides its Duration, and hath but one Indication.

When he comes to ſpeak of intermitting Fevers, he gives us another Argument to prove their Cauſe is a Poyſon, and that is, becauſe it produces the ſame Symptoms which other Poyſons do, to wit, Faintneſs, Vomiting, Univerſal Sickneſs, Spaſmodick Pains, *&c.* But this is ſo mild a Poyſon, that the Animal Spirits are rather vex'd and irritated, than deſtroy'd by it, and by their own Elaſticity rid themſelves of it in a ſhort time. This Poyſon, he ſays, cannot be lodg'd in any part of the Body, except in the Fibres, becauſe the whole Body being vaſcular, the Blood circulating perpetually thro' all the parts, would otherwiſe be put into a continued Feveriſh Commotion; but in the Fibrous Filaments it is at liberty to put the Spirits into Periodical Exploſions. Speaking of the Procatarctic Cauſes of Intermitting Fevers, he acquaints us how they come to be Endemical in ſome places, and why thoſe who ſeem equally liable to this Diſtemper from the evident Cauſes of it, are not equally ſeized with it. Then he ſolves the *Phænomena* of the Symptoms with great Perſpicuity, diſcourſes of the Duration of this Fever, and ſhews, that the *Cortex Peruv.* is not the occaſion of the frequent Returns of this Diſeaſe, and proves that the Ferments of Quotidian, Tertian and Quartan Intermittents are not ſpecifically different.

He thinks it not worth his while to enumerate the Diagnoſtics of this Diſeaſe when it is regular and genuine; but becauſe it is often ſo obſcur'd by the Violence of ſome particular Symptom, that it is frequently miſtaken for ſome other Diſeaſe, as Head-ach, Apoplexy, Colic, Pleureſie, *Cholera Morbus*, *Diarrhœa*, Dyſentery, *&c.* He reckons up the ſeveral Diſtempers which it ſo exactly imitates, and teaches us how to diſtinguiſh it from them, which is chiefly to be done by the Colour and Contents of the Urine, and the Periodical Exacerbation of the Symptoms. In his Chapter of Prognoſtics he obſerves, that no body dies of an Intermittent but in the Cold Fit. That the Symptoms are often of more dangerous conſequence than the Poyſon it ſelf. That an Emetick, or ſometimes ſome ſlight Remedies given before the Third Fit often cure the Diſeaſe; but if the Fever hangs long upon the Patient, it is often turn'd into a Continu'd Fever, or produces Chronical Diſtempers, which will not be cur'd without the uſe of the *Cortex Peruv.* with ſeveral other remarkable things, of all which he gives the Reaſon. In the Chapter of the Intentions of Cure, he lays down two Indications, one in the Fit, and another in the lucid Interval; and tells us how and why Blood-letting, Emetics, Purges, Opiates, Diaphoretics are ſo often very injurious to the Patient. Then he deſcribes the Method to be taken when Intermittents lie hid under the ſhapes of other Diſeaſes. He obſerves by the by, that when this Fever is accompanied with an Effloreſcens like that of an *Eryſipelas*, or Scarlet Fever, it is alſo joyn'd with a *Periodical Diarrhœa*, or *Cholera Morbus*. He gives the reaſon how it came to paſs, that the Ancients were ſo abſurd in the Cure of this Fever, and how Specifics were brought in requeſt; and here he treats of all the known Specifics, as *Amulets*, *Pericarpia*, Infuſion of *Crocus Metallorum*, Diaphoretic Antimony, Salt of Wormwood, Bitters, *&c.* and ſhews their uncertainty; and communicates the Receipt of a Powder, with which he hath cur'd ſome Intermittents, which would not yield to the *Cortex Peruv.* which *Cortex* he conſiders in two whole Chapters.

In the firſt of which is contain'd the Natural Hiſtory of this Bark, the Name of the Tree, the time of its coming into uſe in *Europe*, and how the *Europeans* came to the knowledge of it. It ſeems it met with great oppoſition when it was firſt brought into uſe at *London*; and ſome Phyſicians cry'd it down becauſe it perform'd the Cure (as they thought) too ſoon; others, becauſe they could not reconcile the manner of its Operation to their Hypotheſis and Doctrine of Humours, declaim'd againſt it as a Medicine too hot or too dry, or ſome way or other not qualify'd for the purpoſe. Some Foreigners indeed defended it, and maintained that it had Qualities, ſuch as Heat, Tenuity of Parts, &c. by which it might well enough effect the Cure of Agues: But our Author concludes, that it cures them, not as it is hot or dry, or poſſeſſed of any other Qualities; to which purpoſe he gives an Inſtance of a Fruit in *Sardinia*, that hath the ſame degrees of Heat and Siccity with the *Cortex*, which creates a Tertian as certainly as the *Cortex* cures it; and therefore the Arguments for or againſt the *Cortex* taken from its manifeſt Qualities, are in his Opinion of no Validity. After he hath anſwer'd the Objections and Calumnies of abundance of Foreign Authors againſt this Medicine, he declares that he hath never in 25 years Obſervation ſeen any ill effect of the *Cortex*, only a ſmall temporary Deafneſs, which vaniſh'd upon the Omiſſion of the Medicine. But if the Patient hath a great Antipathy to the Bark, it ſometimes cauſes Vomiting and Fainting, and ſo does Honey, and ſeveral other very innocent things when they meet with a peculiar Idioſyncraſie. The Author conſiders in the next place, how the *Cortex* performs this Cure, and makes it appear that the ſeveral Solutions which have been given of this *Phænomenon* hitherto, are inſufficient; then diſcourſes of the Nature of Poyſons and Antidotes, and the manner of their Operation; and ſhews that Fevers have manifeſt Symptoms of Poyſon accompanying them, and ſuch as would be produc'd by Arſenic, Mercury, Colocynthis, or ſome other known Poyſon, and then concludes that the *Cortex* cures Them, as other Antidotes do other Poyſons, and waves any farther nice Speculations concerning the manner of its Operation, which he knows can be but meer Gueſſes and Conjectures, and is contented to give an undeniable Proof that it is an Antidote: Among other Arguments to that purpoſe, he thinks the ſmalneſs of the Doſe in which he gave it when it came over unadulterated, before the Merchants were ſenſible of its Value, and before *Talbor* knew it or made uſe of it, may paſs for One; and the Performance of the Cure without any Evacuation, for another. He deduceth ſome Coralleries from what he hath ſaid on that Subject, and by the by teacheth us how External Medicines conduce toward the cure of Fevers; then proceeds in the next Chapter to give the Marks of the true and genuine Bark, becauſe that of the Shops is generally adulterated, and ſets down ſeveral Forms in which he gives it, with this Remark, That it muſt be given always in Subſtance, becauſe the Chymical Preparations of it are ſcarce ever found to have any Efficacy; and ſubjoins ſeveral Rules, which, if well obſerv'd, may prevent the return of the Diſeaſe.

The Hiſtories in the 9th Chapter, which confirm all that he hath laid down in the preceding Treatiſe, are not of Regular intermitting Fevers cur'd by the *Cortex*, it being granted that Agues are daily ſo cur'd, but of ſuch as were conceal'd under the Symptoms of other Diſeaſes, as Colic, Apoplexy, Rheumatiſm, Peripneumony, Univerſal Spaſm, &c. which is a Work of great moment in the Practice of Phyſick, and was never undertaken by any other. Among thoſe Hiſtories is one very remarkable of an Intermittent, which was partly occaſion'd by the Stone of the Kidneys; and Three, of Patients which he cur'd with his own Specific when the *Cortex* would not prevail, and in theſe Hiſtories he is very punctual and exact, and ſets down all the particulars that were any way material in this method of Cure.

The Second Exercitation begins with a general Diſcourſe of continued Fevers, whoſe Ferment is in a higher degree Venomous than the Ferment of the Intermittents, and therefore the Spirits cannot caſt it off entirely at once, but are always in a Feveriſh Commotion. If the Spirits in every Conflict gain ground of the Poyſon, tho never ſo little, the Fever is a Remittent; but when the Poyſon is in the higheſt degree venomous, the Spirits are ſiderated in ſome meaſure from the very beginning, and the Fever thereby occaſion'd is continual, without any remiſſion and malignant, becauſe the Poyſon is equal if not ſuperiour to the Spirits. The Venom therefore of theſe Fevers differs only in degree, and Malignant Fevers often-times are changed into Remittent, and Remittent into Malignant: And it is very well worth Obſervation, that Epidemical Fevers, tho highly malignant, have a manifeſt Remiſſion on the Third Day, ſometimes alſo on the Fifth and the Seventh; and when they draw towards a good Criſis, and the Spirits begin to be expanded, remit again at ſet times. Hence it is to be concluded, that a Remitting Fever is not fatal, unleſs it be accompany'd with ſome Symptomatical Inflammation or Colliquation. How the Poyſon in the Remittent Fever comes to produce theſe Symptoms is here ſhewed by the Author. Continued Malignant Fevers he reſerves for a Fifth Exercitation.

After this he comes to diſcourſe of Remitting Fevers in particular, which he divides into Genuine and Spurious. By Spurious Remittents he means thoſe which are accompany'd with ſome violent Symptom; then he gives a Deſcription of the Diſeaſe and its ordinary Symptoms, and a very good Reaſon why every Exacerbation of a Remitting Fever doth not begin with Cold and Shivering as the Paroxiſm of an Ague doth. The Diagnoſtic of this Fever when it is regular are taken from the Exacerbations and Remiſſions, the Pulſe, the Colour of the Urine and Periodical Sweats; but when it is Spurious, it is very difficult to diſcern what Diſtemper it is, for the Violence of the Symptoms make the Fever ſcarce perceptible. Here therefore the Author teacheth us how to diſtinguiſh it, and obſerveth that the Symptoms in this caſe are always ſuch, as argue the ſtrength and vigour of the Spirits, tho they are in part oppreſs'd with the Poyſon; and particularly, that an Effloreſcence like an Eryſipelas about the Noſe and Lips (when it happens) is a certain mark of this Diſtemper. Then he ſpeaks of the Evident Cauſe of this Fever, which he finds to be the Atmoſphere; and that therefore this Diſtemper is conſtant and Endemical in ſome places, and in almoſt all places Epidemical in the Autumn. The Prognoſtics are theſe which follow, and ſeveral others: The Remitting Fever before it becomes fatal is always turned into a continued Fever without Remiſſion, and is very apt to degenerate into it about the ſtate of the Diſeaſe, eſpecially if the Symptoms are ſuppreſs'd raſhly and without good Caution. The Spurious Remittent is not more fatal than the Simple in its own Nature, but on the Account of its Symptoms. A Remittent ſometime after the ſtate of the Diſeaſe turns into an Intermittent, which is very apt to return, and very hard to be cur'd. The Criſis of this Fever when left to Nature is tedious and uncertain. The *Cortex* makes as certain a Cure in the Remittent Fever as in the Intermittent, but in the Spurious Remittent it hath not its Effect ſo ſoon. This Fever cur'd with the *Cortex* is apt to return in the ſhape of an Intermittent; but when it is cur'd by Nature, the Patient ſeldom hath a Relapſe. No critical Solution of this Fever is certain but Sweating and Salivating. The ſtrength of the Pulſe is always a good ſecure ſign, tho the Symptoms ſeem terrible and dangerous. Almoſt all Epidemical, Autumnal and Camp-Fevers are either Genuine or Spurious Remittents.

There is but one thing Indicated in this Fever, that is the Correction, or rather Abolition of the Poyſon, which occaſions all the Tumult; unleſs the Spirits are put into Exploſions, or the Humours colliquated, or the Fever inclining to Malignancy; for in theſe caſes there ariſe ſeveral Indications. But becauſe this Poyſon is not always extinguiſh'd by the ſame means, but ſometimes by its proper Antidote, ſometimes by the natural and repeated Expanſion of the Spirits. Our Author ſhews what is to be done when the Diſtemper is left to Nature; and tho he looks upon that to be a very uncertain way of Cure, yet he lays down the Rules to be obſerv'd in this Rational Method, by which if a Phyſician be guided, he ſhall do nothing that is abſurd or Emperical; and therefore gives a Deſcription of the Diſeaſe, and its ſeveral Stages when it is left wholly to its ſelf, and the Reaſons of its Symptoms. For inſtance, Why the Laſſitude, Soreneſs, Head-ach and Pains, whether fixt or moveable, vaniſh of their own accord in the ſtate of the Fever, whatever its Event is like to be: How the ſeveral Stages come to be of an uncertain Duration, and longer and ſhorter as the Spirits are ſtronger or weaker, &c. He ſhews the Faults or Miſtakes and ill Practice of three ſorts of Men in this Rational Cure, namely, of the Ancients, of the Modern Chymiſts, of the Surgeons and

Apothecaries; then lays down his own Scheme of Practice according to his own Hypotheſis, and deſcends to every particular Symptom, and ſhews in what manner it is to be dealt withal: And here he takes occaſion to diſcourſe particularlyof the uſe of *Alcalies*, *Veſicatories*, *Suppedanea* and *Pidgeons* or part of Animals apply'd outwardly to any part of the Body, of *Alexipharmicks* and *Opiates.* But tho the Author hath done ſeveral Cures this Rational way, yet conſidering its tediouſneſs and uncertainty, and the Proclivity of the Fever it ſelf to degenerate into a Malignant, and the ſeveral other Inconveniences of this Method, he hath treated it for ſeveral Years after the other Method, which he is juſt going to deſcribe.

When the Remittent is Genuine, the Antidote is to be given as ſoon as the Fever remits; and there is nothing elſe needful; for when the Poyſon which is the Fuel of the Fever is taken away, the Flame muſt neceſſarily go out. But if the Fever be permitted to encreaſe till it is ready to turn malignant, or hath its Type almoſt loſt and diſguis'd by the violence of ſome Symptom; after Blood-letting, *&c.* the Spirits muſt be erected with Theriacal Bolus's and Veſicatories, and then the Anditote will take place. If the Patient is inclin'd to vomit, and cannot retain this unpalatable Medicine, the Tone of the Stomach muſt firſt be corroborated, and the Acrimony of its Ferment ſoftned and rebated, and then ſome *Laudanum* muſt be mixt with the Antidote. The Author takes notice alſo how a *Symptomatical Diarrhœa*, or *Cholera*, and the Symptoms of Inflammation and Exploſion are to be manag'd; and obſerves, That when this Fever is accompany'd with Inflammation, it will not be cur'd without quantities of the *Cortex* larger than ordinary; and that when it is joyn'd with Exploſion of the Spirits, thoſe Spaſms will not be quieted with an ordinary Doſe of *Laudanum*, but require that it ſhould be adminiſtred in great quantities, and be often repeated; but the Fever it ſelf muſt always be cur'd with the *Cortex.* When a Remitting Fever is turning Malignant, the *Cortex* is ſtill to be us'd as long as the Patient can bear it; but unleſs the Spirits are raiſed by Epiſpaſtics and Alexipharmicks to a degree of Vigour fit to actuate and guide the Antidote, the Antidote muſt needs be uſeleſs. To this Treatiſe the Author ſubjoins ſeveral ſelect Hiſtories of Spurious Remittents, ſome of which degenerated into Malignant Fevers, the better to illuſtrate his Hypotheſis, and to confirm the admirable uſe and vertue of the *Cortex.*

He concludes his Book with a Compendious Hiſtory of this Remitting Fever from the Year 1658. to the Year 1692. in which it is very obſervable that the great Plague in 1665. (of which here is a brief Account) did not quite obliterate this Fever; and that when Dyſenteries reign'd ſo much in *London* from 1666. till 1672. the Flux and the Gripings were only Symptomatical, but the Diſeaſe it ſelf a Remitting Fever, and was ſucceſsfully cur'd by the *Cortex* mixt with *Laudanum.* Here is likewiſe an Hiſtory of the Meaſles, which were Epidemical in the *Autumn* 1672. which very much reſembled a Remitting Fever, and in ſome caſes admitted of the uſe of the *Cortex*: But he ſays little upon that Subject, deſigning, as ſoon as his other Employments will give him leave to publiſh an entire Treatiſe of the Meaſles, Scarlet Fever, Small Pox, and other Inflammatory Fevers, in which he hath already made good Progreſs.

Catalogus Plantarum Horti Academici Argentinenſis, in uſum rei Herbariæ Studioſorum, Adcurante Marco Mappo Med. Doctore & Profeſſore Seniore, & Archiatro Argentinenſi Argentorati apud Jo. Fredericum Spoor, 1691. in 12°.

THE Author in his Preface tells us, that Phyſicians have been obliged of late very much to enlarge their Enquiries, beyond what in times paſt was cuſtomary with them: So that it is now required of them not only to make a more exact Search into the Myſteries of the Parts and Humours of Humane Bodies by Anatomy into Coſmetics, they being frequently adviſed with on their uſes, but alſo to remedy the Body even after Death, by teaching to embalm and preſerve the ſame. Amongſt theſe Studies is the knowledge of Exotick Plants, which has receiv'd very conſiderable Acceſſions by Phyſitians and Apothecaries, whom Neceſſity forcing to the knowledge of the parts of their own, and Exotic Plants in common and ordinary uſe, they are thereby help'd to judge of the Virtues of others of the ſame kind coming from abroad: And ſeeing this Study is very large, thoſe who are addicted to it ought to be very thankful to any, who by their provident Care and Charges furniſh their Gardens with the moſt elegant Plants of *Aſia*, *Africa*, *America*, or diſtant places of *Europe*, amongſt which this Garden of *Straſbourg* our Author gives the Catalogue of, is one.

He publiſhes this Catalogue on two Accounts; the firſt and chief of which is for the keeping a mutual Commerce between the Author and thoſe who keep

Gardens of the ſame kind, for the furniſhing others with what he has, and being ſupplied with what he wants from them. The other reaſon is, the uſe of thoſe who deſign to attain to the Knowledge of Plants, on whoſe Account he has only given (for the moſt part) one ſingle Name, he obſerving that the multitude of Names given the ſame Plant by ſeveral Authors, in differing Kingdoms, having reſpect to their various Properties, Forms, Virtues and leſſer Accidents, has given great diſturbance to the Learners: On which ſcore this Author almoſt only uſes the Names of *Caſpar Bauhin* in his *Pinax* and Dr. *Herman's* Catalogue of the Garden of *Leyden*, preferring the Names given by *Caſpar Bauhin*, being now commonly uſed by moſt Herbaliſts, even before thoſe very long Names who are ſince given them, for very ſmall reaſons, in place of his. For the Plants not known in *Bauhin's* time he uſes the Names in Dr. *Herman's* Catalogue, as well as for thoſe whoſe Names are to be reform'd, to which he ſubjoins *Bauhin's* Name likewiſe.

The Book it ſelf gives the Names of the Plants in the Garden Alphabetically, wherein are ſome curious Plants gathered from near home and from far, amongſt which are few Non-deſcripts, or ſuch as have not been taken notice of by other Writers, ſome of which may perhaps be Varieties, as may be ſeen more at large in the Book.

Stephani Chauvini *Lexicon Rationale, ſive Theſaurus Philoſophicus*, &c. *Rotorodami, in* Folio, 1692.

THis *Philoſophical Dictionary* is contrived in an Alphabetical Order, and is intended by the Author as a Key to *Philoſophy*, diſcovering what may be known by the Light of Nature, expounding the Philoſophical Terms, and their various Acceptations according to the Ancient and Modern Opinions: It will be ſufficient to inform the Reader, that he explains Words relating to Logic, Natural and Moral Philoſophy: eſpeciallly ſuch as cauſe the greateſt Conteſts in the Schools both of the Ancients and Moderns.

Amongſt them are interſperſed Aſtronomical, Optical, Mechanical, Chymical, and Phyſico-Mathematical Words, chiefly ſuch as explain Bodies and their ſeveral Affections; the whole is rendred the more intelligible by ſeveral Schemes contained in 30 Folio Plates, exhibiting to the Readers view the ſeveral *Hypotheſes*, with the Structures of very many Inſtruments and Machines, as Barometers, Thermometers, Hygrometers, Teleſcopes and Microſcopes, made uſe of by the late Inquiſitive Age in ſearching deeper into the nature of Bodies. As a *Specimen.* I ſhall preſent the Reader with an Abſtract of what he writes of the Teleſcope. Firſt, He gives the Definition, Uſe and Effects thereof; proceeding to ſeveral ſorts, he deſcribes the common one made with a Convex Object Lens and Concave Eye-glaſs, the Aſtronomical Teleſcope, with two Convex Lens's, another with two Convexes and a Concave. The Terreſtrial Teleſcope, with three Convexes, and two others with four Convexes; of each of theſe he gives the Schemes and demonſtrates their Effects.

E R R A T A in ſome former Numbers of theſe Tracts.

NUmb. 192 Page 462. line 4. dele *ſive.* p. 489. l. 26. dele *him.* N°. 194. p. 544. l. 5. r. *ſæpe.* p. 554. l. 6. for *Breaſt* r. *Back.* N°. 195. p. 565. l. 12. r. 162. p. 568. l. 13. for *more* r. *move.* N°. 196. p. 584. l. penult. r. *Chartula.* p. 587. l. 4. r. *noctu.* p. 589. & 590. in Marg. r. *Fig.* 3. p. 593. l. 6. r. *Animalcules.*

L O N D O N:

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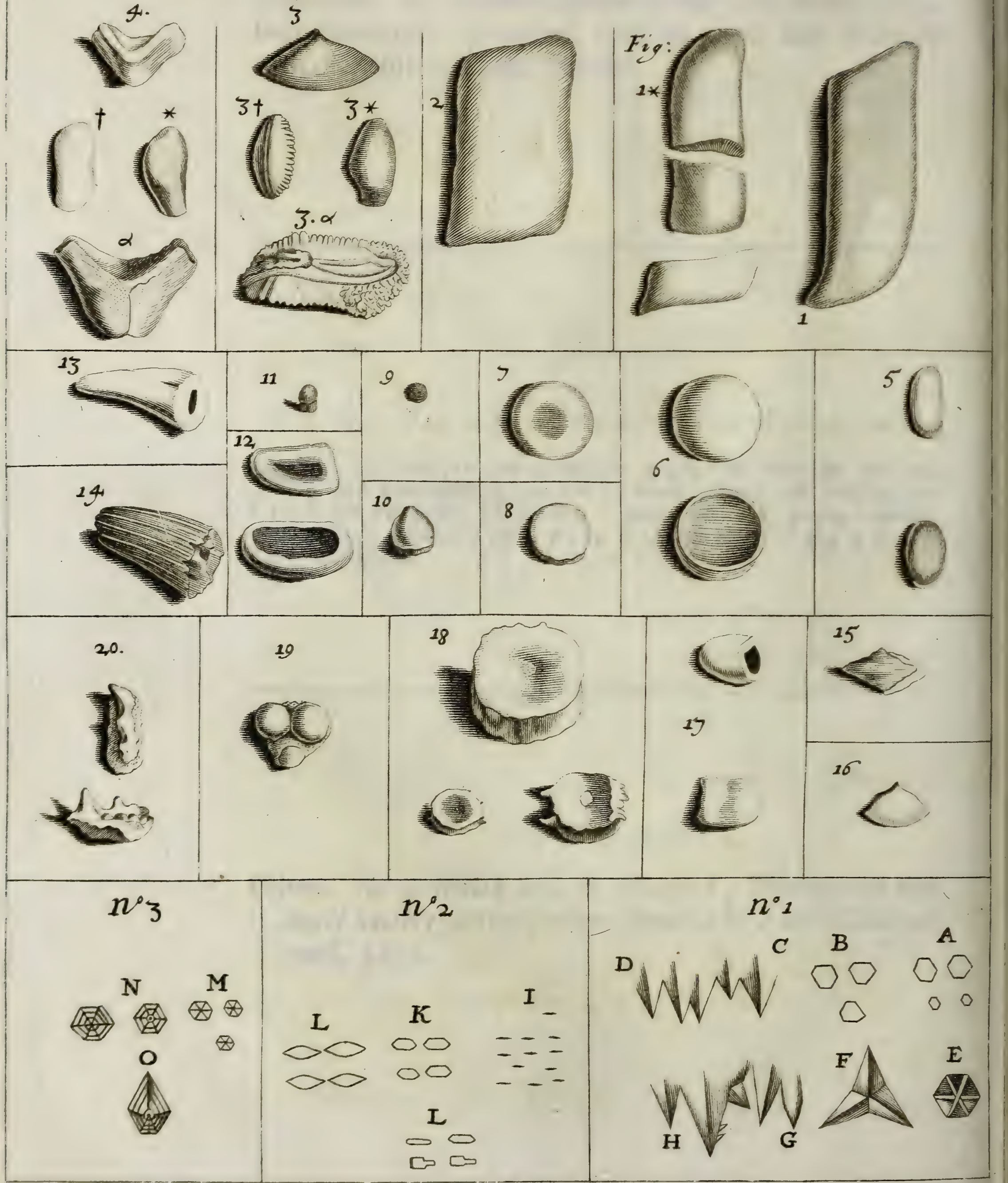

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PHILOSOPHICAL TRANSACTIONS.

For the Month of May, 1693.

The CONTENTS.

I. T*HE Method, Manner and Order of the Tranſmutation of* Copper *into* Braſs, &c. *by* Thomas Povey, *Eſq; S. R. S.* II. *Two Letters concerning ſeveral* Copper Mines, *in Anſwer to ſome Queries propoſed by Dr.* Martin Liſter, *S. R. S. who communicated them to the Publiſher.* III. *Edvardi Lvidii* apud Oxonienſes Cimeliarchæ Aſhmoliani ad Clariſſ. V.D. *Chriſtophorum Hemmer* Epiſtolâ, in quâ agit de lapidibus aliquot perpetuâ figurâ donatis, quos nuperis annis in *Oxonienſi* & vicinis agris adinvenit. IV. *The Extract of a Letter from Mr.* Anthony Van Leeuwenhoek, *S. R. S. to the Royal Society, containing ſeveral curious Obſervations on* Native Cinnabar, *and the firing of* Gunpowder, *with its Contents, and quantity of Air produced by the Exploſion.* V. *The Deſcription of the* American Tomineius, *or* Humming Bird, *communicated by Dr.* Nehemiah Grew, *S. R. S.* VI. *An Account of Books.* 1. Horti Indici Malabarici, Pars Septima, Octava, & Nona, *with ſome Remarks upon*

them. 7. ***A Collection of Curious Travels and Voyages, in two Tomes. The firſt containing Dr.*** Leonhart Rauwolff's ***Itinerary into the Eaſtern Countries,*** &c. ***The Second taking in many parts of*** Greece, Aſia minor, Egypt, Arabia Fœlix, ***and*** Petrea, Ethiopia, ***the*** Red Sea, ***&c. from the Obſervations of Monſieur*** Belon, Vernon, Greaves, ***Dr.*** Spon, Smith, Huntingdon, ***&c.*** Lond. ***Printed for*** S. Smith ***and*** B. Walford, ***in*** 8°. 1693.

I. *The*

I. *The Method, Manner and Order of the* Tranſmutation *of* Copper *into* Braſs, *&c. By* Thomas Povey, *Eſq; brought into the Royal Society, of which he is a Fellow.*

WE have in the North parts of *England* much *Copper*, which places, though as they now lie, are barren and poor, might be rendred rich and uſeful, if a ſufficient Encouragement were given to the Digging and Raiſing thereof, and the Poor thereabout might be put in a good way of Livelyhood, as well as ſeveral other Advantages to be brought thereby to the Publick.

The *Calamine* is digged out of certain Mines, of which there are ſeveral in the *Weſt* of *England*, (as about *Mendip*, &c.) which lie about 20 Foot deep, as Coals do, thence brought up by Sea. It is burnt or calcin'd in a Kiln or Oven made red hot, then ground to Powder, and ſifted into the fineneſs of Flower, and mixt with ground Charcoal, becauſe the *Calamine* is apt to be clammy, to clod, and not ſo apt or capable of incorporating: Then they put about 7 *l.* of *Calamine* into a Melting Pot of about a Gallon Content, and about 5 *l.* of the *Copper* uppermoſt, the *Calamine* muſt be mixt with as many Coles as will fill the Pot. This is let down with Tongs into a Wind-Furnace 8 foot deep, and remains 11 hours therein. They caſt off not above twice in Twenty Four Hours, one Furnace holds Eight Pots. After melting it is caſt into Plates or Lumps. Forty Five Pound of raw *Calamine* produces Thirty Pound burnt or calcin'd.

See *Numb.* 198. of theſe Tracts.

Braß Shruff ſerves inſtead of ſo much *Copper*; but this cannot always be procured in quantities, becauſe it is a Collection of pieces of Old Braſs, which is uſually to be got but in ſmall Parcels.

The beſt *Guns* are not made of malleable *Metal*, and cannot be made of pure *Copper* or *Braß*; but it is neceſſary to put in courſer Metals to make it run cloſer and ſounder, as *Lead* and *Pot-metal*. *Bell-metal* being *Copper* and *Tin*, *Pot-metal Copper* and *Lead*. About 20 *l.* of *Lead* is uſually put into 100 *l.* of *Pot-metal*; but about 6 *l.* is ſufficient to put into 100 *l.* of *Gun-metal.*

The *Calamine* Stones were heretofore fetch'd from *Poland*, but ſince fetcht from hence by the *Dutch.*

The Manufacture of *Braſs* was privately kept in *Germany* for many hundred years, wherein thouſands were employed and well maintained, ſome having thereby raiſed themſelves to great Eſtates.

The *Dutch* may not import (an Act of Parliament expreſly forbidding them) the *Copper* nor the *Calamine* Stone; but contrary to the Ends, and perhaps the meaning of the ſaid Act, and more to the Publick Diſadvantage, they mingle and manufacture thoſe two Ingredients (which are of Foreign Growth to them) and by that Evaſion import them hither: And the great Manufactures of Wire, and ſeveral other Commodities ariſing of thoſe important Materials.

II. *Two Letters concerning ſeveral Copper Mines, in anſwer to ſome Queries propoſed by* Dr. Liſter, *S. R S. who communicated them to the Publiſher.*

LETTER I.

S I R,

ACcording to your deſire I have given you an Anſwer to the Queſtions about the Copper Mines to the beſt of my knowledge, which are as followeth.

The Firſt Query is, *What quantity of unwrought Copper Ore is left upon the place, and where it is, and in whoſe hands, and what is the reputed value of a Tun of unwrought Copper Ore?*

To which I anſwer, *That there is a heap of Ore by* Darwent *near* Keſwick; and I ſuppoſe no body lays Claim to it, but it is not worth any thing; for being there ſo long, the Weather hath eaten out all the Copper that was in it. And for the value of a Tun of Copper Ore unwrought, I know not what it is worth, neither is there any in this Country that can tell; neither can any Man know, except there were Ore got, that the Goodneſs or Badneſs may be ſeen by the more or leſs mixture of Stone that is in it, or by other Symptoms of kindly Ore.

The Second Query is, *What uſe can be made of the Slaggs of Copper Ore? and whether they can be waſhed over again, as is practiſed in Lead-works?*

The only Anſwer that I have to this Queſtion is, That I do not know any thing of it, neither can it be known

in

in this Country, all the Ancient Men that wrought at the Smelting of it being dead; but it may be Mr. *Hextecher*'s Book will give ſome Account of it. That Book is in Mr. *Anglionby*'s Cuſtody at *Carliſle*.

The third Queſtion is, *What Thickneſs and Goodneſs the Vein of Copper Ore is reputed to be of?*

In Anſwer to which I ſay, It is reported that the *thickneſs of the Vein at* Gouldſcope *in* Newlands *was ſix Foot*; but for the goodneſs it cannot be known without compariſon of divers ſorts, to ſee which is beſt; and no Compariſon can be made in things unſeen.

The fourth Queſtion is, *What number of Shafts and Addits are at the Work? and what the great Addit coſt? and when was it finiſhed? and if it be yet finiſhed? if not, what will it coſt to clear and perfect it?*

To which I anſwer, That I have divers times viewed and well conſidered both of *Caldbeck* and *Newlands* Mines, and know that there is no Shafts in being neither at *Caldbeck* or *Newlands*; and if there hath been any, they are filed up, and will be of no uſe for any that ſets the Work on again, by reaſon that the Copper is wrought away from under them. There are divers Addits finiſhed, which will be of no uſe, being that they will not clear the Work of Water: For the old Workmen have wrought down the Ore far below the Addits by the benefit of Water Engines and Pumps; ſo that there can be no good done without new Addits. There is part of an Addit wrought at *Caldbech*, but how much it wants to be finiſhed I know not, neither can I tell what it will coſt the finiſhing: For the Stone may be harder or ſofter; for ſome Stone may be wrought for 20 *s. per* Fathom, and ſome of it may prove ſo hard, that it may coſt 10 *l. per* Fathom, beſides many Inconveniences which now lie hid, will in the working of it appear, as the ſinking of Air-Shafts, or other Engines for that uſe.

The fifth Query is, *What quantity of Copper Ore was uſually landed out of* Caldbeck *Mines in a Year, and what quantity of Lead in the ſame place? and whether more Copper might not be wrought out of the ſame Mine alone, if more Hands and a greater Fund had been provided ready to defray the Charges?*

To the firſt part of this Queſtion I cannot anſwer, but ſhall refer you to *Hextecher*'s Accompts, which will give you ſome light in it. And to the latter part of the Query I anſwer thus, That no doubt a greater quantity of Copper might be got out of the ſame Mines, if more Hands and a greater Stock were provided.

The ſixth Query is, *What Men are yet alive about* Keſwich, *or elſewhere, in the County of* Cumberland, *that have actually wrought in the Copper Mines; and what Ability of Body to work again, or to direct other Miners in the ſame Mine.*

To which I anſwer, That I have made Enquiry, and cannot hear of any that is alive that did actually work in thoſe Mines; and if there be any, they are ſo old, that they are not capable to direct others.

The ſeventh Query is, *Whether* 1000 *l. Stock or Fund will ſufficiently ſet on foot the* Caldbeck *Mines, and bring the reſt in ſome years to perfection?*

To which I anſwer, That 1000 *l.* Stock will be enough to begin with to get Ore; and when there is Ore gotten, there muſt be Smelting-Houſes built, which will coſt 500 *l.* or more, if they are well built; ſo that it will take up a long time before the Work be brought to Perfection. That is to ſay, before Copper be made ready for ſale at the Market, it will be 6 or 7 years at leaſt, and by that time 10000 *l.* will be Stock little enough: Though it will be laid out gradually, yet in that time before the Work come to pay it ſelf, it will require the afore-mentioned Stock.

And this is the beſt Anſwer that I can make to the Queries; but *there are Queſtions of greater Importance than thoſe, which ought to be well anſwered before the Copper Mines be ſet on work.*

What I have referred you to Mr. *Hextecher*'s Book is not becauſe I admire his way of Working the Mines, eſpecially towards the latter part of the management of it; for I know the Ill Management was the deſtruction of it in the working of the Mines only: For I know that the Mines might have been wrought with one third of that Money to better purpoſe, as I can ſufficiently demonſtrate, if required: But for the Smelting Part I am ignorant of it. Nothing elſe, but due Reſpects from your humble Servant.

Brathwaite, Jun. 28.
1684.

David Davies.

LETER II.

An Account of the Names of the ſeveral Copper-works, or Mines, in Coniſton-fells, *which were wrought in, when the Smelt-Houſes were up at* Keſwick ; *and of thoſe places diſcovered ſince, which were never wrought in ; taken from three old Men hereafter named, who were Workmen in the ſaid Works, and are all of thoſe Workmen who are now living in this County of* Lancaſter.

THE firſt Work that was found and wrought in by the *Dutch-men* in *Coniſton-fells*, is called *Low-work.* It hath a Stulm or Shaft to draw Water from the Mine. When the Smelt-Houſes were up at *Keſwick*, and when they left off working, this Work was left good, and had been wrought from the Day to the Evening-end of the ſaid Work Forty Fathoms, or thereabouts ; the Seam or Vein of Copper-Ore then was left above three quarters of a yard thick of good Ore, which Seam or Vein did go from the Evening-end to the Morning-end of the ſaid Work, and was eſteemed two hundred Fathoms betwixt, wrought as the Vein went ; and was, when left, all near of a Breadth or Thickneſs. The Copper Ore in this Work was mixt with ſome Silver, or Lead-Ore. The three Workmen hereafter named do judge, that about Two Hundred Pounds will recover this great Work.

The ſecond Work is called *White-work* or *New-work*, about Forty Fathom from the firſt ; which was found a little before the Works were given over, being wrought about Ten Fathom deep; the Seam then left was about 22 Inches of good Copper Ore, and may be recovered by theſe Men for Forty Shillings.

The Third Work is called *Toung-Brow*, a little diſtant from the laſt, being wrought about Thirty Fathom, and the Seam about two Foot thick of like Ore; and may be recovered with Three Pounds.

The Fourth Work is called, *God's Bleſſing*, or *Thurdle-Head*, being wrought about Twenty Fathom, and being from the laſt Mine about a Mile; the thickneſs of the Seam of Ore above a Yard when left off; and thought by theſe Work-men much of it to be Gold-Ore, it having been highly prized by their Maſters at *Keſwick*, and may be recovered with about Three Pounds.

The Fifth Work is called *Hen-Cragg*, a Mile from the laſt, wrought about two Fathoms; a ſmall Seam, but excellent Ore, and hopeful to prove a large Seam. A ſmall thing may recover it.

The Sixth Work is called *Sumy-work* at *Levers Water*, at the Water-ſide, and a little above that *Hanch Clockers-work*, a little above that *George Towers* and *William Dixſon*'s *Work*, *Bartle Clocker*'s *Work*, near the laſt *Richard Towers*'s *Work*, then *John Sackloc*'s *Work* and *Hanch Mire*'s *Work*., being all Seven Works, and lie all together, and about a Mile from the Fifth Work abovesaid, and wrought about 10 or 12 Fathom, the Seam of Ore about 16 Inches thick, the Stone very ſoft, and the Ore very rich, and much of the ſaid Ore green, and was very much prized by the Head Maſters at *Keſwick*. All theſe Seven Works may be recovered with about 20*l.* the Seams of them all being near alike in thickneſs.

A little before the Smelt-Houſes left working at *Keſwick*, Mr. *Hecſtetter* had intended to have drawn a Shaft or Sump, to have drained a Tarn which all the Seven Works do ſhut into. He then, if the Works had continued,

tinued, could have had it done for about Sixty Pounds. It was thought then by the Workmen, that if the Tarn had been drained, that all theſe Seven Works would come into one, and that it would be the beſt Work that ever was in theſe parts.

The Seventh Work is called *Gray-Cragg-beck*, found by *William Dixon*, wrought but a little, the Seam about Eighteen Inches thick, of as good Ore as any of the other Works, and very hopeful to have a good Seam. A little will recover it.

The Eighth Work is called *John Dixon*'s *Work* in *Brumfell* then newly found, and wrought about two Fathom, the Seam about 24 Inches thick, and eſteemed the beſt Ore, except *God's Bleſſing*. A ſmall thing will recover it, it being half a Mile from the laſt Work.

The Ninth Work is called the *Wide Work*, or *Thomas Hirn*'s *Work*, wrought about Threeſcore Fathom, and left a Seam above 26 Inches thick when the Work was given over, of very good Ore, and may be recovered with about 30 *l.* It has a Shaft or Sump to draw the Water away, and it is from the laſt Work about Two Miles.

The Tenth Work is called *Three Kings* in *Tilburthwait*, being 3 Works, and wrought above Forty Fathoms apiece, the Seam being above 14 Inches of very good Ore, but a little troubled with Water, having no Sump to draw it away. There is Fall enough to make one, and is near the laſt Work, and may be recovered with about 40 *l.* Theſe are all the Works that have been wrought in *Coniſton-fells*. Moſt of the Works here mentioned have ſmall Seams near the Copper, of a Grey ſort of Ore in ſmall Threds.

The *New Places* diſcovered lately, and never wrought in, and ſeveral found this Year, Three in *Torverwel*, and about Ten in other places, and all near within two Miles of the firſt Work in *Coniſton-fell*, and as hopeful as thoſe that have been wrought in.

Theſe three Work-men do acquaint me, that the Works in *Coniſton-fells* were found a long while after the Works at *Newlands* and *Caudbeck*. When the Ore which was gotten at *Coniſton* came to be ſmelted at *Keſwick*, they found it ſo much to exceed the Copper Ore of either *Caudbeck* or *Newlands*, that they let fall the Works of both thoſe places, and ſent the Workmen from thence to *Coniſton-fells*, and little or none of the other Ore was made uſe of: So that there was above Sevenſcore Work-men kept conſtantly at the Works in *Coniſton-fells*. The Ore which they got there did ſufficiently furniſh and ſupply the Smelt-houſes at *Keſwick*.

They do further acquaint me, That they have heard Mr. *Joſ. Heckſtetter* ſay ſeveral times, That if ever he ſhould be employed as the Head of the Works at *Keſwick*, he would have cauſed new Smelt Houſes to have been ſet up at *Coniſton*, near to where the Ore was got, which would have ſaved a great deal in Carriage, it being above Twenty Miles from *Keſwick*, and none of the way Cartable, and that both Wood and Peates are near, and very plentiful at *Coniſton*, and Stone Coals cheap enough by Sea to help to ſmelt the Ore with; *Penny-Bridge*, our next Sea-Port, being Seven Miles off, two of which Miles are by Land, and Cartible, and the reſt by Water up *Coniſton Meere*.

The Rate that was given for getting of Copper-Ore was according to its Goodneſs, from 8 *s.* a Kibble to 2 *s.* 6 *d.* every Kibble being near a Horſe-Load in weight, it being firſt beaten very ſmall, waſhed and ſifted thro' an Iron Sieve, then meaſured or weighed.

An Anſwer to the Seven Enquiries, as to Coniſton.

To the Firſt : No Copper Ore is already got in *Coniſton.*

To the Second : All Copper Ore is knocked, waſhed and ſifted ; the fineſt at one Rate, and courſer at another, having a Rate according to the richneſs of the Ore.

There was near the firſt Work a *Stamp houſe*, which went by Water, and ſeveral perſons were employed to bring the Refuſe from each Work, that the Miners did throw away, to the Stamp-houſe, where it was ſtamped, waſhed and ordered, and they had 2 *s.* 6 *d.* a Kibble for their pains.

To the Third and Fourth Queſtion: which are anſwered in the Deſcription of the ſeveral Works aforeſaid.

To the Fifth : Here is Copper Ore enough to be got with Men and Money.

To the Sixth : Here are only left alive 3 Workmen ; the Names of them are, *George Towers, William Towers,* and *Henry Dover* ; all able yet to work, and they all live in *Coniſton.*

To the Seventh : A Thouſand Pound will get a great quantity of Ore ; but what the Charge will be in making the Smelt-houſes, they cannot judge, but believe they may be made here at *Coniſton* far cheaper than in any other place in the North, by reaſon of the great Cheapneſs and Plenty of Wood, Stone, and Ground to build on, there being Water ſufficient to ſupply any ſuch great Work ; and there being now an *Iron Forge* upon the ſaid Water, not half a Mile from the firſt Work. This is as exact an Account of theſe Mines as can be got.

Coniſton April, 15.
1684.

Yours, &c.

III. *Edvardi Lvidii* apud Oxonienſes Cimeliarchæ Aſhmoleani, *ad Clariſſ. V. D.* Chriſtophorum Hemmer, *Epiſtola ; in qua agit de lapidibus aliquot perpetuâ figurâ donatis, quos nuperis annis in Oxonienſi & Vicinis agris, adinvenit.*

LUbenter accepi (Vir ornatiſſime) quas ad nos per Clariſſ. *Lodbergium* dediſti literas ; jam antea eiſdem reſponſurus, ſi vel id res poſtulaſſet, vel per otium facilè licuiſſet. Gratias habeo quàm maximas, cùm ob multa alia, tum præcipuè quod circa *foſſilia*, annotata quædam dum in Gallia peregrinatus ſis nobiſcum communicare volueris : ſperòque in patriam reducem, quid ſolum cimbricum ferat aliquatenus edocturum. Nos etiam ex quo huic noſtræ Academiæ valedixiſti, hanc naturalis Philoſophiæ partem non penitus neglectui habuimus : quanquam noſti, Vir Amiciſſime, quàm ad arctos limites damnatus ſim, quamque (longè aliter ac vellem) ad naturæ opera inveſtiganda, mihi parùm otii hactenus obtigerit. Quare neque ſpolia longinqua expectes, neque propinquiora admodum multa. Quædam tamen ex hiſce quæ occurrebant, rariora & magis elegantia (quoniam id rogas) in medium proferam : lapides nempe aliquot quibus numero pluribus, figura perpetuò eadem ; non minùs ac plantis & animalibus. Inter quos primum locum dabimus *Siliquaſtro*, utpote quòd toto genere novus ſit (quantùm nobis ſaltem innotuit) idémque rariſſimus, nec inelegans lapis. Siliquaſtrum autem appellare placuit, quod ſiliquæ lupini vel alterius cujuſdam leguminis, valvulum alterum [cavitate tamen repletâ] non parùm referat. Siliquaſtri notæ genericæ ſunt, *quod ſit lapis figurâ pleréque ad Siliquæ valvulum (ſublato concavo) accedenti; ex parte altera ſemper convexior; & (ſi marmoris inſtar fortuitò expolitos excipias) minutè admodum rugoſus, ſeu ut explicatiùs loquar, crebrò & eleganter malleolatus: facie quaſi oleo obductus, reſplendenti: texturâ ſi comminuitur Belemnitis ferè adinſtar ſtriatâ.* Hujus lapidis plures dantur varietates quarum præcipuas ſolummodo nunc vacat recenſere.

Vide *Figuras.*

Fig. 1. *Siliquaſtrum ad Phaſeoli valvulum quodammodo accedens; ſeu Siliquaſtrum Phaſeolatum.* Figuram titulus indicat; magnitudinem quod attinet, ſeſcunciali eſt longitudine, dimidium unciæ latum, vix quadrantem craſſum. Quoad periferiam, aliud latus quodammodo falcatum eſt, aliud (quod etiam magis acclive eſt) rectum: extremum alterum lineâ obliqua cum duobus angulis clauſum; alterum non item. Ex parte pronâ ſuperficies rectilateris ſtriata eſt, cæterùm leviter rugoſa; & color anthracinus, niſi quod ad utrùmque extremum, paululùm vireſcat. Ex parte ſupina, accretione quadam lapideâ fœdatur, coloris rubiginoſi. Inveni in lapicidina Witneienſi, ſeptimo ab urbe lapide; ſed rariſſimè occurrit. Triplo aut quadruplo minores aliquot, in quibuſdam à jam deſcripto differentes, habeo, è fodinâ Stunsfeldenſi, in hac provinciâ. 1. * Ejuſdem lapidis varietas altera.

2. *Siliquaſtrum lupini Siliquam nonnihil referens: ſeu veniam dabis ſic loqui, Siliquaſtrum lupinatum.* Phaſeolato ſubinde brevior eſt, at ſemper latior: colore incerto ſed ut plurimum à pronâ parte nigro, vel ad nigridinem accedenti; à ſupinâ rubiginoſo. Sed & utrinq; variat quoad colorem & ſuperficiem. A parte gibboſâ lineolis albis & maculis neſcio quibus diſtinctum vidimus; quod & Bufoniis lapidibus & Gloſſopetris quibuſcúnque aliquando accidit. Sed & inveni unum aut alterum cui à parte averſâ neſcio quid appendicis adnaſceretur; in

qua virgulæ aliquot tranſverſæ conſpiciuntur, quaſi amiſſi cujuſdam ignoti veſtigia. Differt hic lapis à præcedente præcipuè, quòd ſit latior magiſque rectus, à neutro latere falcatus. In Anglia Mediterranea non admodum rarus eſt hic lapis. Vidimus in Latomia Garvordienſi in Bercheria, Witneiæ & Charltoniæ apud Oxonienſes, ad pagum Rance in comitatu Northamptoniæ, Honey-comb Laſh apud Waltonienſes, &c.

Dantur etiam & in hoc genere lapides, quos piſi vulgaris & viciæ ſiliquas æmulari dixeris: verùm iſtos impræſentiarum miſſos facimus.

3. *Siliquaſtrum minus, triangulum* ; ſeu *minus conchæ adinſtar roſtellatum.* Colore & ſuperficie cum reliquis convenit, ac figuram obtinet ab iis prorſus alienam. Tellinam enim aliquam vel (mavis) concham parvam Anglicanam *Liſteri*, magis refert quam Siliquam. Verum ex facie cum externâ tum interiori ſiliquaſtrum ſe prodit. Stunsfeldiæ habuimus in agro Oxonienſi. (3 *) Siliquaſtrum Oſſiculum è capite Aſelli minoris referens (3†) Os ipſum è capite Aſelli minoris. (3. α.) Os ex capite Aſelli majoris cum fluore adnato.

4. *Siliquaſtro congener* Punctularia *gibboſa, quandoque tortilis, ſuperficie marmoreâ* : ſeu *Siliquaſtrum gibboſum, marmoreum*, argutè admodum pleréque punctulatum. Superioribus magis terſum & expolitum eſt hoc ſiliquaſtrum: ex pronâ parte nunc magis, nunc minùs gibboſum ; & colore ut plurimum nigricanti, aliàs ſubviridi, exalbido, &c. Ex parte averſâ ſeu interiori, neſcio quâ oſſeâ appendice munitur, coloris nigri vel rufeſcentis : ſed hoc in pleríſque deſideratur. Utrinque in mucronem magis obtuſum deſinit quàm priora. In multis quæ videre contigit exemplaribus, pars gibboſa ſoli obverſa, minutula admodum & creberrima oſtendit punctula ; quæ hujus lapidis elegantia eſt non contemnenda. Paſſim occurrit in comitatu Bercheriano & Oxonienſi. Inveni in Lapicidinis ad pagos Marcham Garvord &

Stunsfield. (*) *Punctularia*, &c. minutis punctulis conſperſa Stunsfield. (†) *Punctularia* tortilis. (α) Ejuſdem lapidis major varietas.

5. *Siliquaſtro accedens Ricinus* ; ſeu *Siliquaſtrum minimum inſtar Seminis Phaſeoli.* Ricinus lapis, ſiliquaſtrum eſt omnium quotquot hactenus videre contigit, minimum ; quod Ricini herbæ, vel etiam phaſeoli cujuſdam minoris ſemen, quadantenus exprimat. Supernè ſcaber eſt, planè ut ſiliquaſtra propriè ſic dicta ; colore aut fuſco aut atro-nitenti. Infrà vero decolor eſt, & informis. Witneiæ inveni inſtar Scarabæi, atronitentes ; Stunsfeldiæ autem & ex atra nitentes, & fuſcos. Atque hæc dicta ſint de ſpeciebus ſiliquaſtri. Si verò anxius interrogas, quid exiſtimem de horum lapidum origine : utrum ſcilicet ſint lapides prorſus minerales, & in ipſa terra nati ; an potiùs extraneo alicui hanc formam & eligantiam debeant ? Reſpondeo nondum ſatis maturas eſſe noſtras obſervationes, ut id decernam. Conjicio tamen quòd hos lapides quos nos craſſa ignorantia laborantes ſiliquaſtra diximus ; poſteri ad minimum (ſi non hujus ſeculi Philoſophi) piſcium Dentes & Oſſicula, tuto appelleverint. Certè quod ad ſiliquaſtrum minus, triangulum attinet ; vidimus aliquot ſpecimina, oſſiculis iſtis vulgo notis ex *Aſellorum* capitibus non parùm conſimilia. Atque ut id obiter moneam ; iſta oſſicula in capſulâ penes me aliquandiu aſſervata, fluorem ſeu particulas cryſtallinas emiſiſſe comperi, vide *Fig.* 3. α. Quòd ſi id fecerint in capſulis incluſa ; certè multò magis in viſceribus terræ idem fieri æquum eſt judicare. Ut vero illud experimentum, ad explicandam marinorum metamorphωſin lapideam, non parum conferat : quibus tamen mediis tot ignota, eadémque maximi ponderis conchylia, in Britanniam Mediterraneam advecta ſint ; aut quo impellente tam altè in viſceribus rupium condita ; nobis ha-

ctenus incompertum, ſatemur. Sed omiſſis abditis rerum cauſis, ad effectus redeamus.

6. *Bufonites majuſculus atrorubens inſtar capſulæ glandis quercinæ : lapidis Bufonis varietas prima apud Anſhelmum Boetium delineata.* Colore eſt undiquaque ex atro ſubrubente ; quoad cætera, omnino convenit cum figura Boetii, *p.* 301. *Numb.* 1. Inveni in lapicidinâ Faringdonenſi, apud Bercherianos ; ſed rariùs occurrit.

7. *Bufonites medius rotularis alveolo utrinque donatus.* Color in ambitu ſub-pallidus eſt ; alveolus ab utráque parte rubiginoſus. Cum priore, habuimus.

8. *Bufonites medius Orbiculatus*, ſeu *Bufonites vulgatior Anglicus.* Majuſculo atro rubenti triplo aut quadruplo minor eſt. Colore inſigniter variat ; aliàs anthracino, aliàs fuſco ſive hepatico, aliàs alio. Sed & nonnunquam cæruleis maculis & lineolis notatum vidimus. Unicum habeo craſſiuſculum, & cæteris minùs depreſſum, colore pallido aut exalbido ; atro limbo aut faſciola fimbriatum. In latomiis & ſabuletis Angliæ Mediterraneæ, paſſim obviam habuimus : at ſpecimen noviſſimè dictum, in lapicidinâ Faringdonenſi. Paſſim inveniuntur & minores & minimi Orbiculati, & forma quaſi, in plano ovatâ.

9. *Bufonites minimus à convexori parte rugoſus.* In Agro Gloceſtrenſi & Oxonienſi cum reliquis, ſed rariùs.

10. *Bufonites minor*, *trochili adinſtar faſtigiatus*, ſeu *Bufonites Trochilus dictus.* Coloris eſt ex anthracino ſubcærulei, & fimbriâ nigra donatus. E ſabuleto Faringdonenſi.

11. *Bufonites minimus Trochilo affinis*, *calyculo ſtriato longiuſculo donatus.* Caliculus ſtriatus caſtanei coloris eſt : umbonis idem ferè color ac præcedentis. In Sabuleto Faringdonenſi aliquoties obſervavimus.

12. *Bufonites Scaphoides*, *extremo altero latiore.* In lapicidinis Marchamiæ & Garvordiæ, & ad Faringdoniam non admodum rarus. Omnes Bufonites ut id ſemel

dicam, variant colore ; at Anglicani ut plurimum ad nigrum, fuſcum, & hepaticum accedunt. Hos lapides in Anglia, ante hac inveniri non conſtat : nam Bufonites D. Plot in Hiſtoria Oxonienſi, hujus loci non eſt: Bufonites D. Chriſtophori Meret (ſi locum memini) lapides non erant ; ſed ipſiſſimi lupi piſcis dentes, &c. Quod quidem ſatis feliciter ſive ab ipſo ſive à quovis, alio, excogitatum. Quippe hi lapides aliud non ſunt, me Judice quam luporum aliorúmque piſcium dentes, habitu & veſtitu lapidum perſonati. In fodinâ Garvordienſi ſeptimo ab Academiâ milliari, (ob rariores quos habet lapides, diutiùs à me frequentatâ) tandem incidi in maxillæ piſcis ut videtur fragmentum ; cui tres bufonites triangulato quodam ordine, arctè inhærebant ; bini ſcilicet *Fig.* 19. orbiculati minores, & minimus tertius. Sed de Bufonitibus hæc dicta ſufficiant, quos ſi id magis placeat Ichthyodontes Scutellatos in poſterum jure merito appellare poteris.

13. *Plectronites lævis mucrone paulò acutiore.* Plectonitres non aliud eſt quàm Icthydos quidam tereti-formis, plectrum gallinaceum referens, radice Bufonitis inſtar, excavatâ. Colore, ſuperficie & magnitudine, ut reliqui Ichthyodontes variant. Paſſim in lapicidinis Bercherianis, cum Bufonitibus & Gloſſopetris inveniuntur. Striato perioſteo denudatos ſuſpicor quotquot marmoris adinſtar politos cernimus.

14. *Plectronites major altiuſculè ſtriatus, mucrone magis obtuſo.* Hujus lapidus non niſi duo exemplaria hactenus videre contigit. Quid à priore differat ex Titulos colligere poſſis. E fodina Stunsfeldienſi.

15. *Rhombus minor ſive medius.* Quem rhombum appellare placuit, compreſſior eſt quidam lapis ; præterpropter cucumerini ſeminis magnitudine ; formâ ad rhomboidem accedenti. Ab uno latere convexior eſt, & colore ut plurimùm nigro : Ex altero planior, & teſtaceâ quadam lamella obductus ; quæ miré ſplendet,

colore anthracino vel ex atro rubenti. Hæc teſtula ſive teſtacea lamella figuram rhomboidalem conſtituit, margine quandoque leviter inclinato ; & quoad materiæ elegantiam, elimatum Teſtudinis exuvium quàm proximè ſimilat. Invenimus in lapicidinis Marchamenſibus & Charletoniæ. Dantur etiam & majores & minimi, & quidam figurâ à rhomboidali multùm diſcrepantes. Rhombum quoad materiæ & coloris elegantiam excipit.

16. *Scalpellus.* Eſt autem Scalpellus, lapis figurâ ab omnibus huc úſque notis prorſus alienâ. Quod ad magnitudinem ſpectat & colorem, cum rhombo aliquatenus convenit. At figurâ eſt omnino ſibi propriâ. Scalpellum nominare volui, quoniam cultelli mucronem quodammodo mentitur. Nam lamellatus eſt lapillus ; figurâ tamen trigonali, cum alio quodam angulo minùs eminenti. Facies altera omnino plana eſt & ſeſſilis ; ſed altera ob demiſſum marginem, ſeu mavis tranſverſas quaſdam lineas eminentes, undiquáque leviter acclivis. Charletoniæ habui cum priore.

17. *Bufoniti Congener* Gibbus *lapis* : *ſeu Bufonites gibbus cognominatus.* Rarioris hujus lapelli de Bufonitibus agens, oblitus ſum : iis ſiquidem adnumerare debui quantumvis aliâ gaudeat figurâ. Gibbus autem lapis, ex re nomen habet ; nam Bufonites eſt non ut reliqui planè ſeſſilis, ſed omnino arcuatus : adeo ut ſi in plano poſueris, lucem ſubtùs recipiat. Atque hinc à dorſo elatiori, apud nos gibbi nomen ſortitus eſt. In parte gibbosâ, foramem obtinet ad baſim latiorem ; ei prorſus ſimile quo cæteri donantur Bufonites minores. In arenoſis Marchamiæ Lapicidinis invenit optimæ ſpei juvenis D. Joannes Archer è Collegio Reginenſi : qui inter alios lapides aliquam multos ; ejuſdem duo vel tria habet ſpecimina. Nos poſtea in ſabuleto Faringdonenſi obſervavimus. Hactenus dictos lapides ut & alios aliquam-multos, quos in Anglia Mediterraneâ inveni ; pro

piſcium dentibus aliiſque capitum oſſiculis aut habeo, aut vehementer ſuſpicor. Cæterum & eorundem vertebras non paucas undiquaque in agris Glocestriæ Bercheriæ & Oxonii ſparſas, obſervare licuit; quos omnes generali nomine.

18. *Ichthyoſpondylos* appellare conſuevimus. Sunt autem ii variò pro conditione loci, tincti: alii nigri, fuſci alii; quidam ſublutei aut cinerei. Magnitudine etiam & formâ non minùs variâ ſunt quâm Ichthyoſtea ſuperiùs dicta. Invenimus qui latrunculos luſorios magnitudine exuperent; atque etiam viciæ ſemine minores. In arenoſis fodinis Marchamenſibus ſine ullâ ferè (ut mihi viſum eſt) materiæ oſſeæ jacturâ conſervatos vidimus. Porró *Ichthyoſpondyli* aut raro aut nunquam inveniuntur pluribus ſimul junctis; ut piſcium vertebræ: Magno quidem indicio me judice, has non eſſe lapides ſpontaneos ad imaginem (cognatæ quantumvis materiæ) oſſium, formatos. Nam ſi *natura ſubterranea*, quod *marina* perficit, præſtare conatur; quidni eodem opere ac labore quo ſingularem piſcis vertebram; integrum ſaltem Sceleton ut cætera nequeat, conficeret? Sed hanc quæſtionem ſatis ſtrenuè ventilatam habemus, a viro, ſi quis alius Naturæ operum, peritiſſimo *D. Joanne Raio*; in tractatu quodam Phyſico-theologico nuper edito; qui neſcio an ad manus tuas hactenus pervenit. Quamvis & majorem adhuc ſperemus lucem á *D. Joanne Woodward*, Prof. Phyſ. Greſhamenſi, Viro ſiquid rectè ſentio, non diligenti ſolùm & induſtrio; ſed & ingenio perſpicaci,& multimodè erudito. Is enim majorem Angliæ ſubterraneæ partem quà patet, inviſit; & exinde opima ſatis retulit ſpolia: Theſaurum Philoſophicum, quem (irridente quamtumvis populo) *jam contemplatur in arca*: brevi (ſi Deus dederit) Æconomiæ ſubterraneæ ſtudioſis impertiturus. Quin & Clariſſ. Vir, *D. Joannes Beaumont*, cujus urbanitatem una cum deſideratiſſimo Seerupio experti ſumus; in Diſſertationem contra Burnetium editâ,

Hiſtoriam

Hiſtoriam lapidum ſingulari figurâ inſignium, quos in ſua provinciâ naſci comperit; expectare juſſit.

19. Maxillæ piſcis fragmentum lapideum cum adnatis *Bufonitibus*. Garvordiæ inventum.

20. *Gloſſopetra* exigua cum mandibulæ fragmento lapideo adnato. Faringdon.

At vero ad metam inopinatò pervenimus, jam nihil amplius adjiciendi eſt locus; & te forſan diutiùs quam par eſt, hoc uno argumento detinui; quamvis gratiſſimum eſſe jamdudum comperi. Vale (vir Ornatiſſime) amicorum quacunque terrarum non immemor.

Oxonii, 20 *Aprilis*,
1693.

IV. *The Extract of a Letter from Mr.* Anthony Van Leuwenhoek, *S. R. S. to the R. Soc. containing ſeveral Obſervations on Cinnabar and Gunpowder.*

HAving with the greateſt niceneſs examined native *Cinnabar*, I could diſcover therein nothing worthy noting; wherefore I gave it a very ſtrong Fire, upon which it ſoon began to move, many ſmall Particles ſeparating themſelves from the reſt, till they had crept into a cooler place; and notwithſtanding the great Weight of the *Cinnabar*, yet ſeveral conſiderable Particles as big as Pins Heads roſe up from the Fire, and got into cooler places. When the Heat was encreas'd, the *Cinnabar* began to evaporate, a black Smoak ariſing, made up of

ſmall Globules: Examining this *Cinnabar* when cold, I found therein ſeveral ſix-ſided Figures, ſuch as is repreſented N°. 1: *A*, of which ſome were very regular, others not; they were of different ſizes, ſome of the bigneſs of a ſmall Sand, others an hundred times leſs; ſome were of the *Fig. B.* ſhaped like an Equilateral Triangle with the Three Points cut off. I never found any of theſe Figures in the *Cinnabar*, till it had been expoſed to a ſtrong Fire, which ſeparated them from it, notwithſtanding which it ſtill retained its red Colour, only was ſomewhat browner.

Some part of the *Cinnabar* that lay next to the fire appeared as *C D*; ſome Particles alſo were like *E*, others like *F*, and ſome with ſeveral Points and ſolid Angles, as *G H*. Beſides theſe Figures, there was a blackiſh matter, which like Smoak had been ſeparated from the *Cinnabar*, where I found a great number of exceeding ſmall Globules of *Quickſilver*, and admired at the great quantity thereof contained in the *Cinnabar*: Amongſt theſe Globules lay ſome, which I judged to be Salt Particles; but for their extreme minuteneſs I could not diſcern their Figure.

When I burnt the *Cinnabar* in the open Air, there aroſe a Flame very like that of *Brimſtone*; but upon examination I could not find that the inflammable parts thereof were true *Brimſtone*. Then I cauſed the Flowers of Brimſtone to ariſe, which I viewed, and found, amongſt ſeveral irregular parts, ſome Globules tranſparent like Oil; and the higher they roſe from the Fire, the ſmaller were theſe Globules, till in the end they became undiſtinguiſhable. The Volatile parts of *Cinnabar* could not be driven very high, tho' with a great Fire, whereas thoſe of *Brimſtone* were raiſed much higher with a ſmall Heat. I obſerved in the *Brimſtone* ſeveral Salt-Particles, conſtituted, as I gueſs'd, of many ſmall united Globules. For I ſuppoſe they were raiſed in a round

Figure, which ſubſiding ſhoots into Angles, eſpecially if they meet with any Moiſture.

Powdering ſome *Cinnabar*, I expoſed it to the Fire as before, and found therein ſix-ſided Figures, with ſome triangular ones, whereof ſome had one, others more Angles broken off; with other differing Figures with one acute Angle, but there were no Squares or Oblongs. I often found amongſt them a conſiderable quantity of Oil, with ſome tranſparent parts which I took for Salts; this Oil lay fartheſt from the Fire: and I judged the Flame which I ſometimes obſerved, might be from the burning of theſe Oily parts.

I then poured Rain-water on ſome of this *Cinnabar* that had been raiſed by the Fire without flaming; and when it had ſtood in the Air till part was evaporated, I found a great number of Salt Particles of a longiſh Figure, as are repreſented N° 2. *I.* And tho' ſome of theſe were bigger, yet I judged them to be formed of the ſmaller ones united together. Amongſt the reſt ſome were pyramidal, conſtituted on a ſix-ſided Baſis, and ending in a point like little Diamonds. There were Salts of ſome other Figures, as Oblongs, *&c.* So that no eſtimate can be made of theſe Salts. It is true Rain-Water affords a Salt, but it is in ſo ſmall a quantity as not to be conſidered in this Experiment.

Then I poured Rain-water on beaten *Cinnabar*, and after ſome Weeks ſetling, and in part evaporated, I found therein an inconceivable number of Salt Particles, of which I could not diſcern the Figures they were ſo ſmall, my beſt Microſcope ſhewing them no bigger than a Sand appears to the Naked Eye; only I fancied ſome were Sexangular. Boiling ſome of this Water, and evaporating part of it, the aforementioned Salts were to be ſeen in greater quantity; ſome of the largeſt are repreſented, magnified, N° 2. *K. L. L.*

Having therefore thought that the Salt Particles which were raiſed up by the force of the Fire, muſt neceſſarily be of a Spherical Figure, as being ſoftned and melted by the Heat, I was willing to be ſatisfy'd herein; and remembring ſome Remarks I had formerly made on Gun-powder, I took ſeveral clean Glaſs Vials from 3 to 6 Inches long, theſe I heated to dry them, and rarify the Air, and then put therein one or more of the largeſt Corns of *Gunpowder*, and cloſed them up to exclude the common Air, and placed them in ſo great a Heat that the Powder took Fire, filling the Glaſs with a white Smoak, ſome of the Cole and Brimſtone ſticking to the ſides; but putting in more Corns, they were carried up much higher, ſo that I could very diſtinctly diſcern the Brimſtone from the Nitre; for it lay ſo thick in ſome places, as to exhibit a yellow colour, and might, by a good Microſcope be ſeen moving circularly in the white Smoak, which was the *Nitre*; tho the Particles thereof were very ſmall, which, when moving, appeared perfect Spheres, which leiſurely ſubſided to the bottom of the Glaſs: Wherefore I laid the Glaſs along, that the Particles of the *Nitre* might be diſtinct from thoſe of the Coal and Brimſtone; and then I found thoſe Particles which before ſeemed Globular, were, when fixed on the ſides of the Glaſs, all ſhot into ſix-ſided Salts. Some were like Nº. 3. *M. N.* with others irregular as O, and ſome of theſe ended pyramidally like little Diamonds. Some of the Salt-peter Particles which lay mixt with the others were long and ſlender, and looked like little bundles of Arrows.

Beſides the forementioned parts, I obſerved a Moiſture in the upper part of the Glaſs upon the firſt firing of the Powder, which I gueſs'd might come from the *Nitre*, and therefore ſhall call it Oyl of *Nitre*, tho' poſſibly there might be ſome Oyl of *Sulphur* mixt therewith; for further Satisfaction I put ſome refined

Nitre by it ſelf in a Glaſs, leaving a ſmall hole in the top to prevent its burſting, and gave it ſo great a heat, that the *Nitre boyled*, and found in the upper part of the Glaſs a very tranſparent fluid matter, or Oyl, which at another time was curdled together in irregular Figures, and ſtuck to the Glaſs.

Not fully ſatisfied herewith, I repeated the Experiments with the powder, and immediately after its blowing up, I viewed the Glaſs with a Microſcope, and could then diſcern the very ſuddain change or ſhooting of the Globular Particles of the *Nitre* into Sexangular Salts, and that all at once. The number of theſe Salt-Peter Particles afforded by one Corn of Powder, is inconceivably great, beſides thoſe of the Sulphur and Coal. Theſe were beſt ſeen when I fired but one Corn; for when there were more fired, the greater quantity of *Nitre* blew up ſo much of the Sulphur and Coal, that the change and ſhooting of the Salts could not be ſo well ſeen. If I fired the Powder with Heat from below, the Coal and Sulphur would be blown up; but if with Heat from above, but few Particles of the Coal, and yet fewer of the Sulphur would be forced up.

Next I fired one, two, and three Corns of Powder in ſeveral cloſed Glaſſes, and ſuffering them to cool, I opened them (ſome after 4 or 5 days) and found always compreſt Air therein, which flew forcibly out. That I might know the quantity of this generated Air, I opened ſome of them after ſuch a manner, that the Air contained therein iſſued into a Bolt-head with a narrow Neck, which was filled with Water, which, as the Air ruſhed in, was forced out; by which Experiment I found the Air compreſs'd eight times what it was before; or, which is the ſame thing, when at liberty took up eight times the room it did before.

Not fully ſatisfied herewith, I put one Corn of Powder in a Glaſs, and cloſing it up with a very ſmall hole only at the narrow end, which end I placed under the Water in the glaſs Veſſel as before, and firing the Powder, ſo great a quantity of Air was thereby generated, as forced out 160 Grains of Water. Now 13 Corns of Powder weigh but one Grain; wherefore multiplying 160 by 13, which makes 2080, we find that Gunpowder fired expands it ſelf 2080 times, or takes up ſo many times the Space it did before.

I obſerved likewiſe that the Glaſs wherein the Powder was fired would be always filled half full of Water immediately after the Exploſion, the reaſon of which I conceived to be the great rarefaction of the Air, by the Heat of the Fire and ſtroke of the Powder, which upon cooling takes up leſs Space, and the Water enters in to fill up the reſt to prevent a Vacuity.

From this laſt Obſervation, I concluded that a Bullet cannot be ſhot with ſo great a Force out of a very long Canon, or other Gun, as out of one ſomething ſhorter: And diſcourſing ſince with a certain Commander upon this Subject, he told me he was once preſent when upon a Wager a Cannon of 14 Foot threw a Ball much farther than one of 18 Foot.

As to the Reaſon, how ſo great a quantity of Air comes to be generated, tho' I thought of ſeveral Solutions, yet I could not ſatisfie my ſelf; I ſometimes thought that the Particles of the Air were by the violent motion broken and comminuted into ſmaller, and ſo between each Particle a much finer Subſtance might be placed, but this did not anſwer ſo great an Expanſion. Upon the whole, I concluded that the greateſt Improvement that can be made in ſhooting, is, if poſſible, ſo to order the matter, that all, or the greateſt part of the Powder be fired at once; and when this is effected, a much leſs quantity will ſerve than is now uſed.

To examine yet farther this matter of new-made Air, I took one Grain weight of Crabs Eyes, to which I poured Wine Vinegar, and in 4 hours as much Air was generated as filled the ſpace of 44 Grains of Water; and 3 Grains of Crabs-Eyes produced about three times as much. This new-made Air kept its Expanſion for 12 hours that I obſerved it, whence it appears to have been true Air.

V. *The Deſcription of the* American Tomineius, *or Humming Bird, communicated by* Nehemiah Grew, *M. D. and Fellow of the Royal Society.*

THere is in moſt parts of *America* a Bird called by the *Engliſh* the *Hum Bird*, by the *Spaniard Tomineius.* He is of a moſt excellent ſhining green Color, and very reſplendent; the Colour doth ſomething reſemble ſome of our *Engliſh Drakes-heads.* It doth inhabit in ſome of the colder parts of *America*, as well as in the hotter. It is the leaſt of all Birds that I have ſeen there or in *England*; her Leg and Foot together is but half an Inch, the other parts anſwerable, the Trunk of her Body not an Inch. I did weigh one (in thoſe parts) as ſoon as ever it was kill'd, whoſe Weight was the tenth part of an Ounce *Avoirdupoize*, which I take to be about the Weight of a Coined Six-pence. And I have weighed here in *England* a *Tit-mouſe* (which I take to be the leaſt Bird here) and it weighed above Two Shillings, and ſome Half a Crown. I ſaw one of their Neſts made of Cotton-Wool, in form and bigneſs of the

Thumb of a Man's Glove, with the Taper end ſet downwards, wherein were two Eggs of the bigneſs of a Pea, of oval Form. Who can but admire to ſee the whole Body, and all the parts of a Bird folded up in an Egg, little bigger than a Pepper-Corn? They feed by thruſting their Bill and Tongue into the bloſſoms of Trees, and ſo ſuck the ſweet Juice of Honey from them; and when he ſucks he ſits not, but bears up his Body with a hovering Motion of his Wings: But for the relation that he is a curious ſinging Bird, I think it untrue. God in many of his Creatures is bountiful, yet not laviſh; for I did obſerve them ſeveral years, but never heard them ſing; and the Peacock and Jay, though they be of a fine Plume, yet no Singers; and ſo I think this Bird is ſo beautiful to the Eye, as not at all to pleaſe the Ear. An *Indian Soggamore* is not in his full Pomp and Bravery without one of theſe Birds in his Ear for a Pendant. He is call'd the *Hum-bird* or *Humming Bird*, becauſe ſome ſay he makes a noiſe like a Spinning Wheel when he flies, which I think rather an Imagination than real; for I have been many times very near them, both when they hover'd and when they did fly, and I never heard any Noiſe; beſides, their Body and Wings are too ſmall to ſtrike Air enough to make any Noiſe. But of this I ſhall not be poſitive, becauſe ſome Authors are oppoſite to me. It is a Solitary Bird: I never ſaw but two at a time together, *viz.* the Male and the Female, they being eaſily known when together, the Male being ſomewhat bigger than the Female.

If one take a ſmall Birds Wing, and ſtand 4 or 5 yards from a Candle (when dark) and open the Wing, and look thro' it at the Candle, he may ſee a moſt elegant Colour of red and green, which green doth ſomething reſemble the Colour of this Bird.

VI. An Account of BOOKS.

I. *Horti Indici Malabarici.*

Pars Septima, Octava, & Nona; *with ſome Remarks upon them.*

THE Six firſt Tomes being abbreviated in the *Philoſoph. Tranſact.* N. 145, and N. 198. This proceeds with the *7th*, *8th* and *9th*, the fruitful Product of that great *Mæcenas* of the Botanick, and other Natural Studies, the Noble *Heer Van Rheed*, whoſe vaſt Deſigns being not confin'd to *Aſia* alone, have already ſurvey'd and deſcrib'd the moſt luxuriant part of *Africa,* which he intends to publiſh (after the finiſhing of theſe his *Oriental* Diſcoveries) with the ſame Fidelity, Exactneſs and Magnificence that we ſee in the admirable Work before us.

The *7th* Part treats of Scandent and Bacciferous Shrubs, the greateſt part whereof were never taken notice of by any Writer, or elſe but very imperfectly touch'd upon: As the *Natsjatam* or *Battavalli,* which is the *Cocculus Indicus* of our Shops, us'd in Ointments or Paſtes for the intoxicating of Fiſh, and driving away Lice and Vermine. It is ſemper-virent, and grows in ſandy places up and down the Kingdom of *Malabar*, and other Eaſtern Countries: The Leaves are thick ſet, of the ſhape of a Heart, and of a bitter taſte. The Flowers come out in Cluſters, are monopetaloſe, with five *Laciniæ* or Inciſures, all reflected, like thoſe of the *Nightſhade,* ſending forth an Odour like that of *Eldar.* To theſe ſucceed the Fruit, reſembling Grapes, only 'tis *monococ*; firſt green, then white, afterwards red, and laſtly (when ripe) black. The *Indians* beat the whole Plant up with Ginger, ſpread it upon Flanel, and ſo take off their Corns, and ſoften their Feet; ſometimes they uſe only the Fumigation of the Root burnt with *Bufalo*'s Excrements and the *Bambou Reed*. After the Hiſtory of *the Coculus Indicus*, the Publiſher gives us 4 ſorts of *Caniram*, all a-kin to the *Nux Vomica* of our Shops, of which more in the next.

Schembra-valli, and *Vallia-Pira Pitica* ſeem to be two wild Vines, climbing up the Trees in thick Woods; they (as alſo many other Plants in the hot Climates) are never diveſted of Leaves and Fruit, (of which there will be both green and ripe at the ſame time) always flowring and bearing through the whole year under a kind Sun, whoſe Influence is not ſo bountiful to the *European* Regions.

Malago-Codi is our round, black and white Pepper, which are the ſame, only the latter is decorticated. *Cattu-Tirpali* is the long Pepper of the *Indians*, which they chew with *Calx* and the Nut *Taufel*, (the Fruit of a Palm named *Arequa*) colouring their Spittle with a red Tincture. Theſe three Species of Pepper, with two more of the ſame Family, are all fully deſcrib'd, and exactly figur'd in this *7th* Tome.

Cari-villandi, a ſort of *Sarſaparilla*, for which 'tis us'd by the Natives of *Malabar*; 'tis not unlike the *American Smilax*, call'd *Jupecanga* by *Margrave* and *Piſo*, and *Macapatli* by *Hernandez* and *Recchus*, who make 4 Species of *Sarſa*, all bacciferous.

Mendoni, or the *Lilium Superbum Zeylanicum*, one of the choiceſt Ornaments of the *Engliſh* and *Dutch* Gardens, growing up to a very high ſtature. The Gentiles aſcribe ſtrange Vertues to the Root in Sympathy, Incantations, and other Magick Operations. The Fruit (or rather Excreſcence) ſticking to the Root, ſtops and curbs the proud Fleſh of Ulcers, and is ſucceſsfully given in difficult Births.

To theſe we might add many other rare Plants contain'd in this *7th* part: As 4 ſorts of *Indian Ivy*, not unlike our Trifoliate and Quinquefoliate *Creepers*: Several Exotick *Night-ſhades*, one reſembling our *Dulcamara*; great variety of *Battata's*, or *Ricophora's*, very near a-kin to our *Potatoes*, being alſo of general uſe in the Kitchins of *India*. A curious ſort of *Cuſcuta* or *Dodder*, running up and choaking the Boughs of Trees. A beautiful Scandent Reed like the *Rotang*, with many others.

Horti Malabarici.

Pars Octava.

THE *8th* Tome deſcribes and figures 51 herbaceous and arboreſcent Plants, the greateſt part of them pomiferous or leguminoſe.

The firſt 23 Species may be all referr'd to the Pumpions, the Coloquintida's, the Cucumbers, the Balſom Apples, the Paſſion Flowers or Maracocks, of all which there are great Varieties in both the *Indies*.

Modira-caniram, Tab. 24. *pag.* 47. contains in its Fruit the round flat Stone or Seed, commonly call'd in our Shops the *Nux Vomica*: The Wood of this Tree is ſaid to be the True *Lignum Colubrinum*, a-kin to the *Caniram* of the Firſt Tome of this Work, *Fig.* 37. *pag.* 67, 68. which is the Famous Antidote or Specifick againſt the Bitings of that Indian Serpent, call'd by the *Portu-*

gueſes Cobra Copello, whoſe flat Head is mark'd with the Figure of a pair of Spectacles. This Viper or Serpent I have ſeen in Mr. *Charlton*'s excellent *Muſeum.* The Juice of the Leaves (though poyſonous) apply'd externally, drives away the Gout call'd *Valvida* by the Indians of *Malabar.* *Breynius* in his Second *Prodromus* makes the *Caniram*, and *Modita-Caniram* to be Tree Night-ſhades, *Solanum arboreum Indicum maximum foliis Oenopliæ ſive Nepecæ,*&c. *pag.* 92, 93. But whether the *Nux Vomica* is properly the Seed of a *Solanum,* I leave to the more nice Botaniſts to determine.

Amongſt the Leguminoſe Plants of this 8*th* Part, the *Perim-kaku-valli* is remarkable, which bears a prodigious large Lobe, containing 30 great flat Beans, out of each whereof they make entire Purſes and Snuff-boxes: Theſe Seeds are call'd by ſome *Cor Sancti Thomæ,* and by others *Fabæ purgatrices.* They are ſo common and plentiful in the Iſlands and Continent of *India,* that whole Ships may be loaded with them.

Nai-Coranna is the *Phaſeolus Surattentis Siliquâ hirſutâ pungente*, or our *Couage*, whoſe bliſtering or pricking is ſoon cur'd by the Herb call'd *Thumba.* The Pod and Seed of this Kidney-bean are eſteem'd high provocatives to Venery, (perhaps by the ſame reaſon that *Cantharides* are) and a ſucceſsful Medicine in Dropſies. There is another Species of this pungent *Couage* in *Malabar* call'd *Kaku-valli*, a-kin to, if not the ſame with the *Macouna* of *Braſil*, deſcrib'd by *Margrave* and *Piſo.*

Schanga-Cuſpi is the *Flos Clitorius* of *Breynius*, the Juyce is Vomitive, and the root Purgative. *Konni* a ſort of *Abrus* or *Liquorice*, whoſe Bean is commended in the *Hæmorrhoids.* *Ana-Mullu*, call'd by the *Portugueſes Haſticanto* and *Fabas Turqueſca*, remarkable for its many Galls or Excreſcencies full of Inſects, as alſo for its ſtrong ſharp Prickles, with which the *Indians* bore their Ears for the hanging of their various Pendents of Gold and

Precious Stones. *Paeru* and *Katu Paeru*, call'd by the *Chineſes Lak Goetum*, two moſt delicious *Phaſeoli*, or Kidney-beans, cultivated by the Orientals with extream diligence as the beſt ſort of nouriſhment. *Penarvalli*, reſembling the *Ahovai* of *Thevet* in its Fruit, hanging down like *Bandaliers*, hence call'd *Fruita Bandoliera* by the *Portugueſes*. This Plant is us'd as a powerful Antiſpaſmodick by the *Indians*. The reſt of the Herbs in this 8*th* Tome may be referr'd to the *Halicacabum*, *Ariſtolochia Clematitis*, and the *Phaſeolus*, of the laſt of which there are many Species in this Volume.

Horti Malabarici.

Pars Nona.

THE 9*th* Part gives us the full Hiſtory of 87 Plants with their lively Icons. The firſt 17 are all *Apocynum's*, ſome creeping, others ſcandent, and ſome arboreſcent, reſembling *Neriums* or *Oleanders*; of theſe there is a wonderful Variety in *Malabar*, differing in their Lanigerous or Cotton-like Seed Veſſels; their milky Juyces are generally corroſive and poyſonous.

The *Todda-vaddi* of our Author, *Tab.* 19. is the *Herba Viva* of *Acoſta*, which grows in many Provinces of *Perſia*; 'tis eſteem'd as a great Traumatick and Lithonthriptick.

Coletta-Veetla, call'd by Dr. *Herman Eryngium Zeylanicum febrifugum, floribus luteis*. The *Indians* chew the Leaves inſtead of *Betel* with the *Fauſel* or *Arequa*, and give the Juice in the *Apthæ* or *Thruſh*.

There are alſo in this 9*th* Volume ſeveral ſorts of Trifoliate and Quinquefoliate *Sinapiſtrums*, many papilionaceous and winged Plants referable to the *Ferrum Equi-*

num, *Aſtragalus*, *Onobrychis*, to the *Æſchynomene's*, *Herba Caſta*, *Mimoſa's*, to the *Senſitive* and *Humble Plants*, to the *Geniſtella Tinctoria*. Of the *Crotalaria* (call'd ſo from the ratling of the Seed, which the little *Indians* play with) there are 5 or 6 different kinds. The reſt are a-kin to the *Euphraſia*, *Pulmonaria*, *Verbaſcum*, *Perſicaria*, *Digitalis*, *Hedera terreſtris*, *Lyſimachia*. Of the *Seſamum* we have two diſtinct Species in this part, as alſo of the *Teucrium*, &c. with accurate Deſcriptions, Figures and Uſes; for all which the Work it ſelf may be conſulted.

II. *A Collection of Curious Travels and Voyages, in Two Tomes. The firſt containing Dr.* Leonhart Rauwolff's *Itinerary into the* Eaſtern Countreys, *&c. The Second taking in many parts of* Greece, Aſia Minor, Egypt, Arabia, *&c. from the Obſervations of Monſieur* Belon, *Mr.* Vernon, *Dr.* Spon, *Dr.* Smith, *Dr.* Huntingdon, *Mr.* Greaves, *and others. To which are added Three Catalogues of Plants growing in the* Levant. *By* John Ray, *S. R. S.*

THIS Work contains the Obſervations of ſo many curious and learned Travellers, that it may juſtly be eſteemed the moſt Judicious and Choiceſt Collection that ever was yet publiſh'd of the *Levant*, and ſome other adjacent Countries.

The firſt Itinerary is that of Dr. *Leonard Rauwolff* who under the Protection and Encouragement of the Houſe of *Auſtria*, travel'd into many of the Eaſtern Parts of the World, where he made it his principal buſineſs to viſit all the Shops, Ware-houſes, Exchanges, Gardens, Woods, &c. in order to learn their Drugs, Merchandiſes, Arts, Sciences, Trades, and the Products of Nature, moſt of which he brought home with him. The late *Iſaac Voſſius* kept 4 large Volumes of *Rauwolff*'s Collections, as one of the rareſt *Cimelium's* in all his Library. Theſe are now preſerv'd with great Care at *Leyden*

Leyden, and ſhewn to Strangers amongſt the many Curioſities of that flouriſhing Univerſity.

Rauwolff begins his Voyage at *Auſpurg*, from whence he travel'd to *Marſeilles*, and there embark'd for *Tripoli*, touching in his Paſſage upon many Iſlands of the *Mediterranean* Sea, as *Scicily*, *Malta*, *Candy*, and *Cyprus*. He deſcribes with great exactneſs the City of *Tripoli*, with its Fruitful Neighbourhood and Trade; he is very particular in his Account of the ſtately *Bagnio's*, of the *Caravanzeries*, the *Batzars*, the *Fundiques*, and indeed of all their publick and private Buildings: He tells us the ways how the *Turks* prepare their Ruſma, their Soap and Pot-aſhes, and afterwards enumerates the Trees, Shrubs and Herbs growing in the adjacent Countrey: He doth not omit the common Obſervations of other Travellers relating to Offices, Employments, Manners, Cuſtoms, Habits, Religions, Diet, *&c.*

From *Tripoli* he proceeds to *Aleppo*, the greateſt *Emporium* of all the Eaſt, laying down very minutely the *Rout* he took. I need only take notice here, that the Author ſhews the ſame Exactneſs and Diligence in deſcribing *Aleppo* as he did before in *Tripoli*; but the Traffick here being much more conſiderable, he therefore is the more induſtrious about the Drugs and Merchandize.

From *Aleppo* he travels to *Bir*, and ſo down the *Euphrates* to old *Babylon*, deſcribing in this Paſſage the City of *Racka*, *Deer*, and *Ana*, with many Obſervations upon the *Arabians*, and upon ſeveral places of *Chaldæa*, eſpecially the Ruines of *Old Babylon*: He afterwards gives a full Deſcription of *Bagdet*.

His Return from *Bagdet* is through *Aſſyria*, the Confines of *Perſia*, and the Province of the *Curters*, to the River *Tigris*, and to *Moſell*, the old *Nineve*; then he continues his Journey through *Meſopotamia* by the way of *Zibin* and *Orpha* to *Bir*, and ſo to *Aleppo*, and *Tripoli* again. Here he gives us a moſt accurate Account of *Mount Libanus*, which he ſurvey'd with that diligence, as never any Traveller did before him.

From *Tripoli* he goes to *Joppa*, and ſo to *Jeruſalem*, viewing the greateſt part of *Palæſtine*, and deſcribing all the Holy Places, with the ſeveral Sects of *Chriſtians* inhabiting there; he never omits the Plants he obſerv'd growing up and down. Afterwards he embarks at *Tripoly* for *Venice*, and ſo from thence he returns into *Germany*, loaded with the Spoils of the Eaſt.

The Second Tome of theſe Collections contain great Variety: As Firſt, Several of Monſieur *Belon*'s Itineraries and Voyages, to *Candy*, *Mount Athos*, from thence thro' *Macedonia* to the Silver and Gold Mines, and ſo thro' *Thrace* to *Conſtantinople*, and from thence into *Ægypt*. This curious *French-man* was ſent with *Petrus Gyllius* to Travel, and write the Hiſtory of Quadrupeds, Birds, Fiſhes, Inſects, Plants and Foſſils, at the Expence and under the Patronage of that great Reſtorer of Learning, *Francis* the *Firſt*, of immortal Memory.

Secondly, Mr. *Vernon*'s Travels thro' part of *Iſtria*, *Dalmatia*, *Peloponneſus*, *Attica*, and *Aſia Minor*. This worthy Gentleman always carried along with him ſeveral uſeful Mathematical Inſtruments, and was exact in his Latitudes: Great things might have been expected from him, if he had not been unfortunately kill'd in *Perſia*.

Thirdly, The Plants obſerv'd by Sir *George Wheeler* in *Greece*.

Fourthly, Several Miſcellaneous Obſervations made by Dr. *Smith* during his Travels in the *Turkiſh* Empire.

Fifthly, Mr. *Greaves* his Accounts of the Latitude of *Conſtantinople*, and of the *Ægyptian Pyramids*. This Learned Mathematician ſeems very exact in his Calculations and Meaſures, being furniſhed in his Travels with all things neceſſary for Obſervation.

Sixthly, The *Ægyptian* Obſervations of *Proſper Alpinus*, who reſided and practiſed Phyſick ſeveral Years at *Grand Caire*, and afterwards for his great Merit was appointed Botanick Profeſſor at *Padua*, by the particular Order of the Commonwealth of *Venice*.

To theſe we find added in this Second Tome ſome curious Remarks of Dr. *Huntingdon*; as alſo ſeveral Itineraries and Voyages into many parts of *Arabia*, as to *Mecha* and *Medina*, to *Moha*, *Aden*, *Zenan*, *Doffar*, &c. and alſo into *Æthiopia* or *Habeſſinia*, with the ſeveral ways of getting into that Kingdom, extracted from Authentick Inſtructions. Amongſt theſe are inſerted ſome Obſervations upon the *Red Sea*, for all which the Book it ſelf may be conſulted, as containing many things not commonly known, and therefore the more to be valued.

At the end are inſerted three Catalogues of ſuch Trees, Shrubs and Herbs, as have been obſerved to grow wild in *Greece*, *Syria*, *Ægypt*, *Candy*, &c. The Names given by *Rauwolff*, *Bellonius*, *Honorio Belli*, &c. being either *Arabian* ones from *Avicen*, *Serapio*, *Meſua* and *Rhazas*; or *Greek* from *Theophraſtus* and *Dioſcorides*; or elſe Barbarous from the preſent Inhabitants: 'Twas thought therefore convenient to add the new Names of late Writers, which do much illuſtrate the whole. For this Addition of Catalogues the Publick is wholly oblig'd to the Pains and Skill of Mr. *Ray*.

ERRATA.

NUmb. 196. p. 584. l. penult. r. *chartulam*. p. 586. l. 3. r. *quādrabili*. l. 17, r. *impatienter*. *l.* 21. *hominum*. p. 588. l. 6. r. *Hippocratis*. l. 9. r. *diviſo*. p. 589. l. 22. r. *parallelum*. p. 590. l. 24. r. *abſolvitur*. l. 32. r. *ſuperficiei*. p. 591. l. 17. r. *æquabit*. l. 19. r. *autem*. p. 592. l. 8. r. *eidem*. l. 13. r. *exſtabat*. l. 17. r. *& utramque*. Numb. 197. p. 625. l. 4. r. *ſtuck*. p. 635. l. 27. r. *Quantity*. p. 638. l. 9. dele *are*. p. 659. l. 14. r. *extruſion*. p. 660. l. 4. r. *aſſign*. p. ult. l. 27. r. *lancinating*.

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Philosoph: Transact: N. 201.

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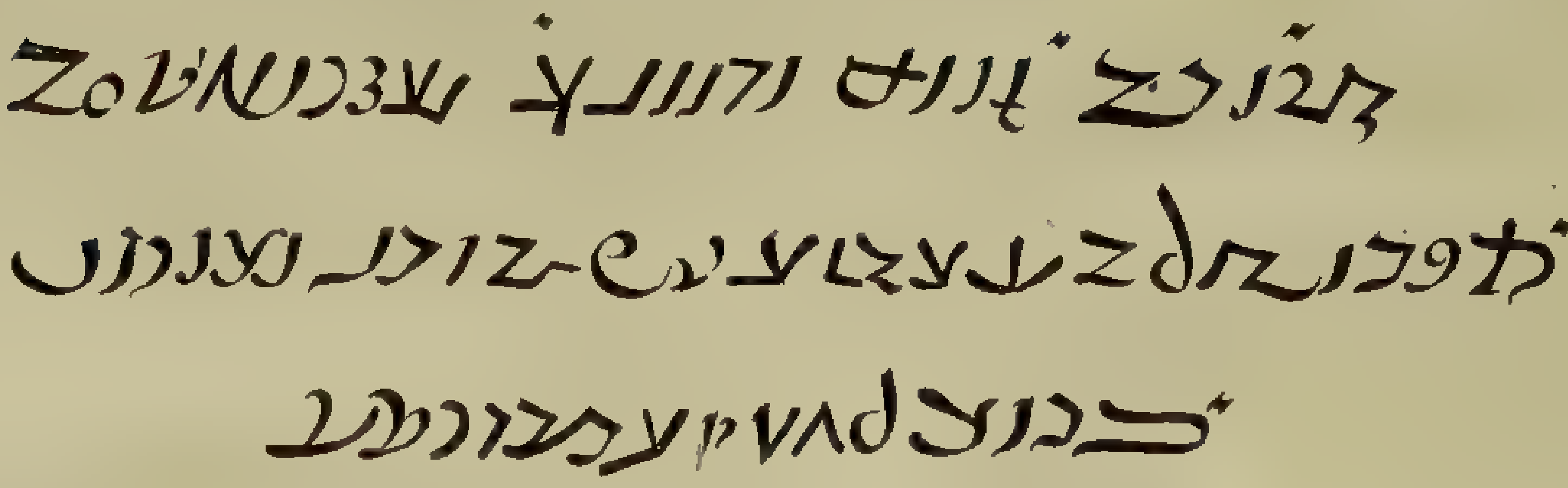

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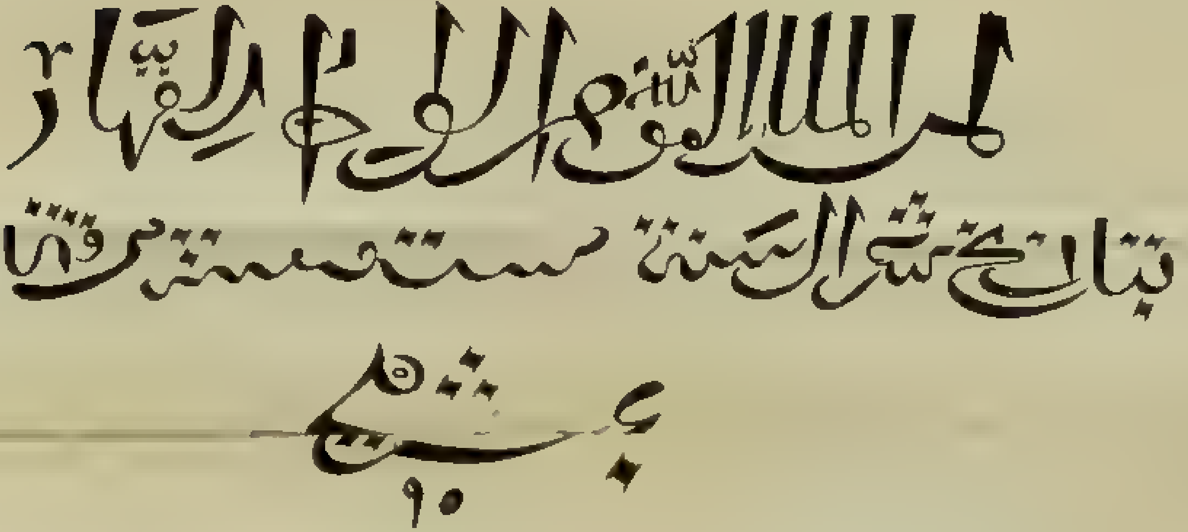

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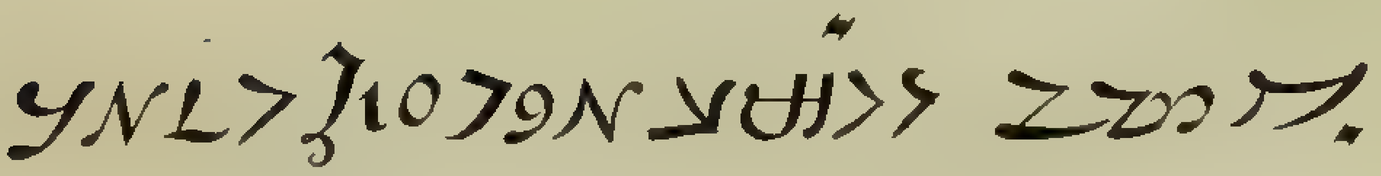

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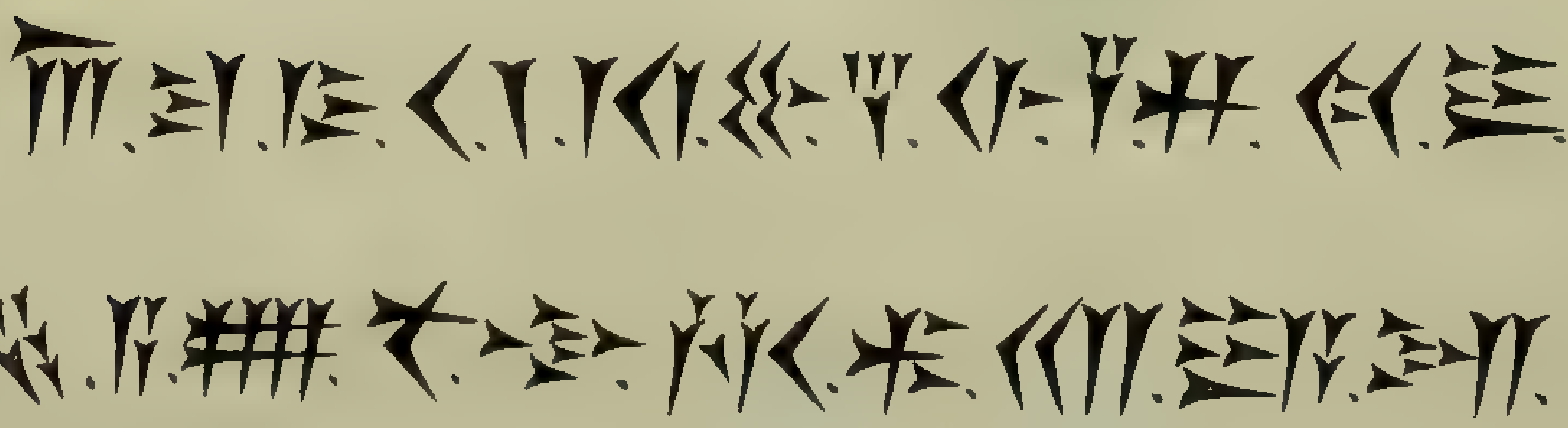

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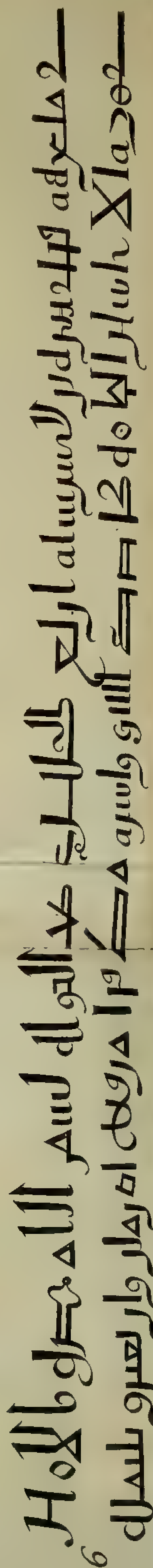
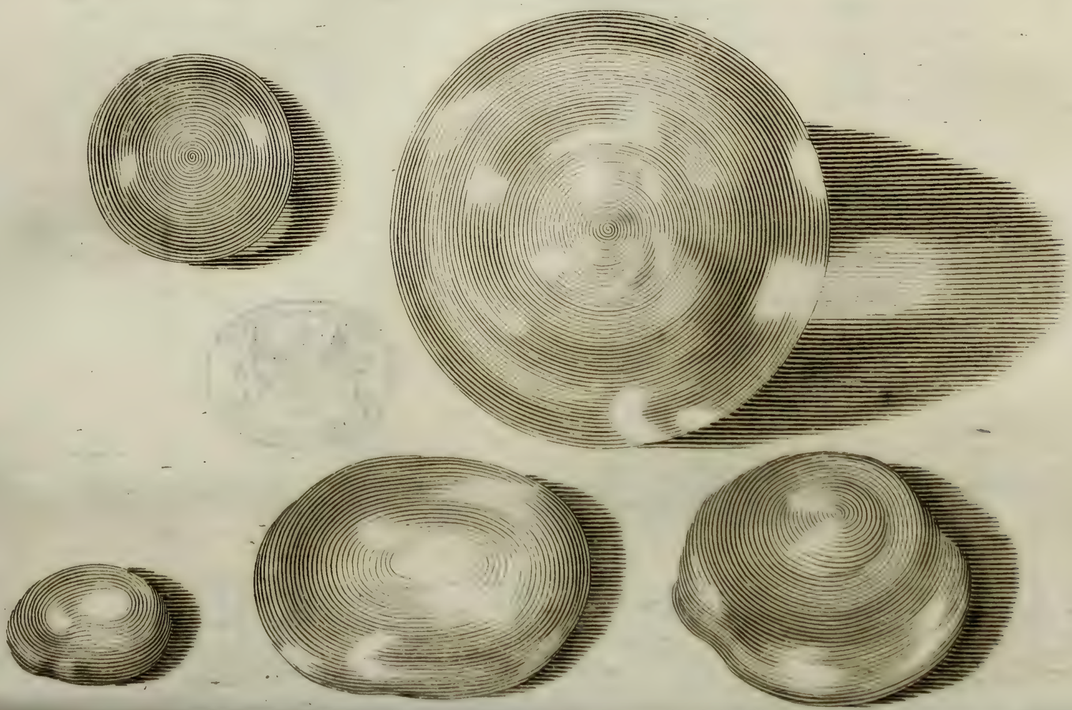


BRITISH MUSEUM NATURAL HISTORY.

N: 201.

Crystalli quædam, sive Echinitæ pellucidj *Anglicanj* ex Silicum *genere, vel* Sphærici, *vel ad* Dimidiatam *Sphæram aliquomodo accedentes .*



PHILOSOPHICAL TRANSACTIONS.

For the Month of June, 1693.

The CONTENTS.

I. A *Letter from* F. A. *Eſq; S. R. S. to the Publiſher, with a Paper of Mr.* S. Flowers, *containing the exact and curious Draughts of ſeveral unknown Characters, copied from the Ruines at* Perſepolis.

II. *An Account of certain tranſparent Pebbles, moſtly of the Shape of the* Ombriæ *or* Brontiæ. *By* Martin Liſter, M.D. *and* S.R.S.

III. *Two Letters from Mr.* John Clayton *Rector of* Crofton *at* Wakefield *in* Yorkſhire, *containing many curious Remarks made by him in* Virginia, *and his Voyage thither.*

IV. *An Account of a Book, by* R. H. *M. D.* R.S. S. Archæologiæ Philoſophicæ ; ſive Doctrina antiqua de Rerum Originibus. Libri duo. Auth. Thoma Burnet. S.T.D. *Londini* Typis *R. N.* Impenſis *G. Kettilby* ad inſigne Capitis Epiſcopi in Cœmiterio Paulino. 1692. *in 4to.*

I. *A Letter from* Mr. F. A. *Eſq;* R. *S. S. to the Publiſher, with a Paper of Mr.* S. Flowers *containing the Exact Draughts of ſeveral unknown Characters, taken from the Ruines at* Perſepolis.

SIR,

I Here ſend you ſome Fragments of Papers put into my hands by a very good Friend, relating to antique and obſcure Inſcriptions, which were retrieved after the Death of Mr. *Flower,* Agent in *Perſia* for our *Eaſt-India* Company; who, while he was a Merchant at *Aleppo,* had taken up a Reſolution to procure ſome Draught or Repreſentation of the admired Ruines at *Chilmenar,* purſuant to the third Enquiry for *Perſia,* mention'd in the *Philoſophical Tranſactions,* pag. 420. *viz. Whether there being already good Deſcriptions in Words of the Excellent Pictures and* Baſſe Relieves *that are about* Perſepolis *at* Chilmenar, *yet none very particular, ſome may not be found ſufficiently skilled in thoſe parts, that might be engaged to make a Draught of the Place, and the Stories their pictur'd and carved.* This Deſire of the Royal Society, as I believe, it hinted at a Summary Delineation, which might be perform'd by a Man qualify'd in a few days, taking his own opportunity for the avoiding much Expence, (which you know they are never able to bear :) So I cannot but think Mr. *Flower* conceived it to be a buſineſs much eaſier to perform then he found it upon the place, where he ſpent a great deal of Time and Money, and dying ſuddainly after, left his Draughts and Papers diſperſed in ſeveral hands, one part whereof you have here, the reſt its hoped may in ſome time be recovered, if Sir *John Char-*

din's exact and accurate Publication of the entire Work do not put a period to all further Curioſity, which I heartily wiſh.

An Exact Draught or Copy of the ſeveral Characters engraven in Marble at the Mountains of Noctureſtand *and* Chahelminar *in* Perſia, *as they were taken in* November 1667. *By Mr.* S. Flower.

N 1. *N* 2. Theſe two Characters are engraven on the Breaſt of two Horſes cut out of the Mountain of Black Marble at *Noctureſtand*, diſtant a League from *Chahelmanare*, or the ancient *Perſepolis*, one whereof is ſaid to be *Alexander*'s, the other *Ruſtram*'s, (a Famous Hero ſuppoſed to have lived about the time of *Cambyſes*.) Mr. *Fl.*

N 1. This Character hath ſome Similitude with the Ancient Hebrew, but the *Perſians* would have it their own, tho' they underſtand not a Letter. Mr. *F.*

N 2. In theſe Lines the places are prickt where the Letters were defaced and not perceptible. Mr. *F.*

N 4. Theſe two Lines were writ entire on *Ruſtram*'s Horſe. Mr. *F.*

N 3. This is the (*Arabick*) *Perſian* Character engraven at *Perſepolis* not above 500 years ſince, and is little different from the Writing us'd at this day. Mr. *F.*

N 5. This Character, whether it be the ancient Writing of the *Gaures* or *Gabres*, or a kind of *Teleſmes* is found only at *Perſepolis*, being a part of what is there engraven in white Marble, and is by no Man in *Perſia* legible or underſtood at this Day.

A Learned Jeſuit Father, who deceaſed three years ſince, affirmed this Character to be known and uſed in *Ægypt*. Mr. *F.*

It ſeems written from the Left Hand to the Right, and to conſiſt of Pyramids, diverſly poſited, but not joyned together. As to the Quantity of the Inſcriptions, *Herbert* reckon'd in one large Table Twenty Lines of a prodigious Breadth. Of this ſort here are diſtinct Papers, each of ſeveral Lines.

N 6. This Character is likewiſe engraved at *Perſepolis*, of like Antiquity with the former. It has ſome Affinity with the *Syriack* and *Arabick*, and has been pretended to be underſtood by ſome of the *Padres*. Mr. *F.*

II. *An Account of certain tranſparent Pebles, moſtly of the ſhape of the* Ombriæ *or* Brontiæ : *Wherefore I have called them* Brontiæ Læves, Pellucidæ, Reſplendentes, Adamantum Æmulæ.

THE Figures are taken from certain very clear and tranſparent Stones found in *England*, of a conſtant Shape. They are called in ſome ancient Leaſes of Royal Mines Rough or Mineral Pearl. They underſtanding, as I gueſs, by the Word Pearl, any thing that was reſplendent and bright, and particularly figured like a Drop of Water, which theſe Stones have of themſelves naturally, and without any Artifice ; ſome of them being exactly Spherical, others like a Half Globe, others like a Half Oval, with an edge raiſed on the top : And in theſe general Figures great Varieties are to be obſerved.

As for the Eſteem the Ancients had of them, it was not without Reaſon ; for beſides that, their natural Figure and Beauty, where they have been well preſerved, is commendable. Their Natural Poliſh is moreover not to be counterfeited, but very eaſie to be diſtinguiſh'd by a Microſcope, from the Artificial Poliſh of Glaſs and Cryſtals. Now Gold, Silver, Diamonds and Pearl are for no other reaſon eſtimable, but becauſe they have certain indelible Characters,which all the Subtilty and Wit of Man hath not yet been able to Counterfeit, notwithſtanding the many Pretences thereunto. As Gold, for Example, for that it will endure the drowning in Antimony ; Silver, that it abides the Teſt of Lead ; Diamonds, for that of themſelves, even without a Foil, they caſt a

Luſtre. Pearl is valued becauſe of it's Figures and peculiar Brightneſs not to be imitated.

Theſe Stones are of the *Peble kind*, that is, not to be calcin'd by ſimple Fire; whereas moſt other figured Stones are calcinable with a very eaſie Fire.

Theſe Stones are, as I ſaid, naturally poliſh'd and very hard and ſolid, and do not conſiſt within of *Laminæ* or Flakes, but brake every way with great Difficulty, and naturally throughout ſmooth.

As for their Figure, it comes neareſt that of the *Ombriæ*; and many of them are very *Ombriæ* in ſhape. Other tranſparent *Ombriæ* I have ſeen, which yet are either very Flints, or of a flaky and ſoft Contexture, of the nature of *Selenites*; and ſuch are to be found about *Filobriggs*, a noted Set of Rocks near *Scarborough*.

As theſe Stones are of a very different Nature and Texture from all other *Ombriæ* I ever yet ſaw, and having no *Veſtigia* of any *Spinæ* in any part of them, I may reaſonably enough conclude them to be Stones of their own kind: And they are in ſhape like ſome of the *Ombriæ*, yet for the Reaſons above-ſaid, they will not come, I think, within the ſuſpicion of having been Animal Subſtances.

For the reſt, I am not averſe to think, after ſo manifeſt and conſiderable Diſcoveries of this kind, as *Auguſtino Scilla* had made in *Sicily*, that moſt of the *Ombriæ* have been *Echini*; and yet ſome of the Prickled, which Naturaliſts have hitherto called *Lapides Judaici*, may have belonged to ſome of thoſe *Ombriæ*. But I perſwade my ſelf it will never be found, that any of them have ever belonged to any of the Stones in the preſent Table.

I ſhall conclude with one Remark, and that is, to incite the Induſtry of the Curious, to a more narrow ſearch into theſe matters. There are but two or three *Echini* yet diſcover'd, either in ours or the *Mediterranean*

Sea. But of the *Ombriæ* of *Europe*, beſides theſe preſent Anomalous Stones, there are at the leaſt Twenty Species figur'd and deſcrib'd by *Aldrovandus*, *Anguſtino Scilla*, Dr. *Plot*, &c. and in vaſt quantities in moſt Counties of *England*: And I doubt not many more Species will yet be found out. All which are to be accounted for; as to the natural places, in what Seas they are to be found at this day. And if not in the *European*, as I think they will not, how and whence they came hither into this Iſland in ſuch Plenty. But enough of this.

Yours, &c.

III. *A*

III. *A Letter from Mr.* John Clayton *Rector of* Crofton *at* Wakefield *in* Yorkſhire *to the Royal Society*, May 12. 1688. *giving an Account of ſeveral Obſervables in* Virginia, *and in his Voyage thither, more particularly concerning the Air.*

HAving often times been urged to give an Account of *Virginia*, by ſeveral of the worthy Members of the Royal Society, I cannot but, as far forth as I am able, obey Commands whereby I'm ſo much honour'd, and ſhow my Reſpect by my ready Compliance; tho' I am ſo ſenſible of my own Weakneſs and Incapacity to anſwer your Expectations, that before-hand I muſt Apologize for my ſelf. And indeed by Sea I loſt all my Books, Chymical Inſtruments, Glaſſes and Microſcopes, which rendred me uncapable of making thoſe Remarks and Obſervations I had deſigned, they were all caſt away in Captain *Wins* Ship, as they were to follow me; and *Virginia* being a Country where one cannot furniſh ones ſelf again with ſuch things, I was diſcourag'd from making ſo diligent a Scruteny as otherwiſe I might have done, ſo that I took very few Minutes down in Writing; and therefore, ſince I have only my Memory to rely on, which too has the Diſadvantage of it's own Weakneſs, and of the diſtance of two years ſince now I left the Country, if future Relations ſhall in ſome ſmall Points make out my Miſtake, I thought this requiſite to juſtifie my Candor; for I ever judg'd it villanous to impoſe in matters of Fact; but Deſcriptions of things that depend on memory may be liable to Miſtakes, and yet the Sincerity of the Perſon that delivers them intire.

But

But hereof I ſhall be as cautious as poſſible, and ſhall rather wave ſome things whereof I have ſome Doubts, and am uncapable now of ſatisfying my ſelf, than in any ſort preſume too far. The Method I deſign is, Firſt, to give an Account of the Air, and all ſuch Obſervations as refer thereto, then of the Water, the Earth and Soil; the Birds, the Beaſts, the Fiſhes, the Plants, the Inſects; and laſtly, the preſent ſtate of the Inhabitants: But at preſent I ſhall neither trouble you nor my ſelf with any more than an Account of what refers to the Air alone, being conſcious the Honourable Society may receive ſuch a Glut with the Imperfection of this, as to excuſe me from a farther Relation.

But before I begin, perhaps it may not be impertinent to acquaint you with ſome things that happen'd in our Voyage. We Sail'd in the Ship *Judith*, Captain *Trim* Commander, 'twas Fly-boat built, about 200 or 250 Tuns; ſhe ſprung a conſiderable Leak. When the Captain had made long and diligent Search, had tried all Methods that Sea-men uſe upon ſuch occaſions, or he could think of all in vain, and that the Leak encreaſed, he came penſively to conſult me. Diſcourſing with him about it, and underſtanding that the Ship was Seeled within; ſo that though the Leak might poſſibly be in the fore-part, it would fill the whole Cavity betwixt the Seeling and the Planks, and ſo run into the Hold at all the Crevices of the Seeling up and down: I thereupon conceived, that where it burſt in betwixt the Seeling and the Planks, it muſt needs make ſome Noiſe. He told me, they had endeavoured to find it out that way, and according to cuſtom had clapt Cans to their Ears to hear with; but the working of the Ship, the Tackle and the Sea made ſuch a noiſe, that they could diſcover nothing thereby, I happily bethought my ſelf of the Speaking Trumpet; and having one which I had contrived for ſome other Conveniences, of a differing ſhape from the common ſorts, I bid him take it and apply the broad end to the ſide of the Ship, the narrow end to his Ear, and it would encreaſe his Hearing as much as it augmented the Voice the other way, and would ward the Ear too from the Confuſion of Foreign Noiſe. Upon the firſt application, accordingly they heard it, tho' it happen'd to be at a conſiderable diſtance; and when they removed the Trumpet nigher, they heard it as if it had been the Current of a mighty River, even ſo diſtinctly, as to have Apprehenſions of the bigneſs and Figure of the Hole that the Water came in at; ſo that cutting there the Seeling of the Ship, they immediately ſtopt the Leak.

In the Sea I ſaw many little things which the Seamen call Carvels; they are like a Jelly or Starch that is made with a Caſt of Blew in it; they ſwim like a ſmall Sheeps Bladder above the Water, downwards there are long fibrous ſtrings, ſome whereof I have found near half a yard long. This I take to be a ſort of Sea-Plant, and the ſtrings its Roots growing in the Sea, as Duck-weed does in Ponds. It may be reckon'd among the Potential Cauteries; for when we were one day becalm'd, getting ſome to make Obſervations thereof, the ſportful People rub'd it on one anothers Hands and Faces, and where it touch'd it would make it look very red, and make it ſmart worſe than a Nettle. In my return for *England* we ſtruck a Hauksbill Turtle, in whoſe Guts I found many of theſe Carvels; ſo that it's manifeſt they feed thereon. 'Tis commonly aſſerted by the Seamen, that they can ſmell the Pines at *Virginia* ſeveral Leagues at Sea before they ſee Land, but I could receive no ſatisfaction as to this Point; I could not diſcern any ſuch thing when at a moderate diſtance, I fear much of this may be attributed to Fancy; for one day there came three or four full ſent to tell me they were certain they ſmelt the Pines; but it afterwards prov'd that we were at that time 200 Leagues from the Shoar, ſo that I was ſatisfied that was therefore meer Fancy. Indeed we thought, by the general Accounts of the Ship, that we had been juſt on the Coaſt, but all were deceived by a Current we met with, that at that time ſet about South-Eaſt, or Eaſt South-Eaſt, which when once becalmed we tried thus: We hoiſed out a Boat, and took one of the Scuttles that cover'd one of the Hatches of the Ship, tying thereto a great Weight, and a ſtrong long Rope, we let it ſink a conſiderably Depth, and then faſtning it to the Boat, it ſerv'd as an Ancor, that the Boat could not drive; then with the Glaſs and logg Line we found the Current ſet, as I ſay, Eaſtward, at the rate of a Mile and a half an hour. This Current is of miſchievous Conſequence, it does not always run one way, but as it ſets ſometimes as we proved Eaſterly, ſo does it, as they ſay, ſet at other times Weſterly, whereby many Ships have been loſt; for then the Ships being before their Accounts, they fall in with the Land before they are aware. Thus one year many Ships were loſt on Cape *Hattaraſſe*, and thereabouts.

Of the Aire.

THE Cape called *Cape Henry*, lies in 36½ of the Northern Latitude. The Air and Temperature of the Seaſons is much govern'd by Winds in *Virginia*, both as to Heat and Cold, Drineſs and Moiſture, whoſe Variations being very notable, I the more lamented the loſs of my Barometers and Thermometers, for conſiderable Obſervations might be made thereby, there being often great and ſuddain Changes. The Nore and Nore-Weſt are very nitrous and piercing, cold and clear, or elſe ſtormy. The South-Eaſt and South hazy and ſoultry hot: Their Winter is a fine clear Air, and dry, which renders it very pleaſant: Their Froſts are ſhort, but ſometimes very ſharp, that it will freeze the Rivers over three miles broad; nay, the Secretary of State aſſured me, it had frozen clever over *Potomack* River, over againſt his Houſe, where it is near nine Miles over, I have obſerved it freezes there the hardeſt, when from a moiſt South-Eaſt, on a ſuddain the Wind paſſing by the Nore, a nitrous ſharp Nore-Weſt blows; not with high Guſts, but with a cutting brisk Air; and thoſe Vails then that ſeem to be ſhelter'd from the Wind, and lie warm, where the Air is moſt ſtagnant and moiſt, are frozen the hardeſt, and ſeized the ſooneſt, and there the Fruits are more ſubject to blaſt than where the Air has a free Motion. Snow falls ſometimes in pretty quantity, but rarely continues there above a day or two: Their Spring is about a Month earlier than in *England*; in *April* they have frequent Rains, ſometimes ſeveral ſhort and ſuddain Guſts. *May* and *June* the Heat encreaſes, and it is much like our Summer, being mitigated with gentle Breezes, that riſe about Nine of the Clock, and decreaſe and incline as the Sun riſes and falls. *July* and *Auguſt* thoſe Breezes ceaſe, and the Air becomes ſtagnant, that the Heat is violent and troubleſom. In *September* the Weather uſually breaks ſuddenly, and there falls generally very conſiderable Rains. When the Weather breaks many fall ſick, this being the time of an Endemical Sickneſs, for Seaſonings, Cachexes, Fluxes, Scorbutical Dropſies, Gripes, or the like, which I have attributed to this Reaſon. That by the extraordinary Heat the Ferment of the Blood being raiſed too high, and the Tone of the Stomach relaxed, when the Weather breaks the Blood palls, and like over-fermented Liquors is depauperated, or turns eager and ſharp, and there's a crude Digeſtion, whence the named Diſtempers may be ſuppoſed to enſue. And for Confirmation, I have obſerved the Carminative Seeds, ſuch as warm, and whoſe Oil ſheaths the acid Humours that ever reſult from crude Digeſtions. But Decoctions that retain the Tone of the Stomach, as I ſuppoſe, by making the little Glands in the Tunicles of the Stomach, ſqueeze out their Juice, (for what is bitter may be as well offenſive to the Stomach, as to the Palat) and then Chalibiates that raiſe the decayed Ferment, are no bad Practice; after which, I conceive, Armoniack Spirits might be very beneficial. But their Doctors are ſo Learned, that I never met with any of them that underſtood what Armoniack Spirits were: Two or three of them one time ran me clear down by conſent, that they were vomitive, and that they never uſed any thing for that purpoſe but Crocus Metallorum, which indeed every Houſe keeps; and if their Finger, as the Saying is, ake but, they immediately give three or four ſpoonfuls thereof; if this fail, they give him a ſecond Doſe, then perhaps purge them with 15 or 20 Grains of the Roſin of Jalap, afterwards ſweat them with Venice Treacle, Powder of Snake-Root, or *Gaſcoins* Powder; and when theſe fail *conclamatum eſt*. But to return, 'Tis wonderful what Influence the Air has over Mens Bodies, whereof I had my ſelf ſad Aſſurances; for tho' I was in a very cloſe warm Room, where was a Fire conſtantly kept, yet there was not the leaſt Alteration or Change, whereof I was not ſenſible when I was ſick of the Gripes, of which Diſtemper I may give a farther account in it's proper place. When a very ingenious Gentlewoman was viſited with the ſame Diſtemper, I had the opportunity of making very conſiderable Obſervations. I ſtood at the Window, and could view the Clouds ariſe: For there ſmall black fleeting Clouds will ariſe, and be ſwiftly carry'd croſs the whole Element; and as theſe Clouds aroſe, and came nigher, her Torments were encreaſed, which were grievous as a labouring Womans;

there was not the leaſt Cloud but lamentably affected her, and that at a conſiderable diſtance; but by her Shrieks it ſeemed more or leſs, according to the bigneſs and nearneſs of the Clouds. The Thunder there is attended often with fatal circumſtances: I was with my Lord *Howard* of *Effingham* the Governour, when they brought word that one Dr. *A.* was killed therewith, after this manner: He was ſmoaking a Pipe of Tobacco, and looking out at his Window when he was ſtruck dead, and immediately became ſo ſtiff, that he did not fall, but ſtood leaning in the Window, with the Pipe in his Mouth in the ſame poſture he was in when ſtruck: But this I only deliver as Report, tho' I heard the ſame Account from ſeveral, without any contradicting it. Theſe things are remarkable, that it generally breaks in at the Gable end of the Houſes, and often kills Perſons in, or near the Chimneys Range, darting moſt fiercely down the Funnel of the Chimney, more eſpecially if there be a Fire, (I ſpeak here confuſedly of Thunder and Lightning) for when they do any Miſchief, the Craſh and Lightning are at the ſame inſtant, which muſt be from the nearneſs of the Cloud. One time when the Thunder ſplit the Maſt of a Boat at *James* Town, I ſaw it break from the Cloud, which it divided in two, and ſeem'd as if it had ſhot them immediately a Mile aſunder, to the Eye: It is dangerous when it Thunders ſtanding in a narrow paſſage, where there's a thorough paſſage, or in a Room betwixt two Windows; tho' ſeveral have been kill'd in the open Fields. 'Tis incredible to tell how it will ſtrike large Oaks, ſhatter and ſhiver them, ſometimes twiſting round a Tree, ſometimes as if it ſtruck the Tree backwards and forwards. I had noted a fine ſpreading Oak in *James Town* Iſland, in the Morning I ſaw it fair and flouriſhing, in the Evening I obſerved all the Bark of the Body of the Tree, as if it had been artificially peel'd off, was orderly ſpread round the Tree, in a Ring, whoſe Semidiameter was Four Yards, the Tree in in the Center; all the Body of the Tree was ſhaken and ſplit, but its Boughs had all their Bark on; few Leaves were fallen, and thoſe on the Boughs as freſh as in the Morning, but gradually afterwards withered, as on a Tree that is fallen. I have ſeen ſeveral vaſt Oaks and other Timber Trees twiſted, as if it had been a ſmall Willow that a Man had twiſted with his Hand, which I could ſuppoſe had been done by nothing but the Thunder. I have been told by very ſerious Planters, that 30 or 40 years ſince, when the Country was not ſo open, the Thunder was more fierce, and that ſometimes after violent Thunder and Rain, the Roads would ſeem to have perfect caſts of Brimſtone; and 'tis frequent after much Thunder and Lightning for the Air to have a perfect *S*ulphureous *S*mell. Durſt I offer my weak Reaſons when I write to ſo great Maſters thereof, I ſhould here conſider the nature of Thunder, and compare it with ſome *S*ulphureous *S*pirits which I have drawn from Coals, that I could no way condenſe, yet were inflamable; nay, would burn after they paſs'd through Water, and that ſeemingly fiercer, if they were not over-power'd therewith. I have kept of this *S*pirit a conſiderable time in Bladders; and tho' it appeared as if they were only blown with Air, yet if I let it forth, and fired it with a Match or Candle, it would continue burning till all were ſpent. It might be worthy Conſideration likewiſe, whether thoſe frequent Thunders proceeded from the Air's being more ſtagnant, the Motion of the Winds being impeded by the Trees, or whether the Motion of the Winds being obſtructed by them below, the Motion might not be more violent aloft; and how far that may promote Inflammability, for *S*tacks of Hay or Corn that ferment with Moiſture, never burn, unleſs when brisk Winds blow, that agitate and fan the little fermenting *S*parks, and oft kindle them into an actual Fire. An Obſervance of the Meteors there might perhaps not be impertinent, as both what are more rare, and what are more frequent, as of *Goſimore* in great abundance, and of thoſe ſmall Cobwebs in a Morning, which ſome have ſuppoſed to be Meteors. *Ignes fatui*, tho there be many boggy Swamps and Marſhes, are ſeldom, if any are ſeen there. There be frequent little ſorts of Whirl-winds, whoſe Diameter may be ſometimes not paſt two or three Yards, ſometimes Forty, which whisking round in a Circle, paſs along the Earth, according to the Motion of the Cloud, from whence they iſſue; and as they paſs along with their gyrous or circular Motion, they carry aloft the drie Leaves into the Air, which fall again often in places far remote. I have ſeen them deſcend in a calm Sun-ſhine Day, as if they had come from the Heavens in great Showers thereof, ſo that all the Elements ſeem'd filled therewith. And I could perceive them to deſcend from on high as far as I could poſſibly diſcern a Leaf. I remember a roguiſh Expreſſion of a Seaman, otherwiſe ſilly enough, who wondering thereat, cry'd out, *Sure now 'tis manifeſt there is a World above!* and now with them 'tis the Fall of the Leaf. But to proceed, I thought this made it manifeſt, whence many preternatural Showers have happen'd. I remember at Sir *Richard Atherton's* in *Lancaſhire*, ſome few years ago, there fell a great number of the Seeds of Ivy-berries; at firſt we admir'd what they were, for they were cover'd with a thin skin that was red, and reſembled the Figure of a ſmall Wheat Corn; but afterwards they fully manifeſted what they were; for many ſprouted and took Root. I ſuppoſe they were carry'd aloft by ſome ſuch Whirl-wind, and let fall there. I have purpoſely gone into the place where I perceiv'd this Guſt, which is notorious enough by the noiſe it makes, with ratling the Leaves as it carries them aloft, and have found a fine ſharp Breeze of Wind. *Yours*, &c.

Mr.

Mr. Clayton*'s Second Letter, containing his farther Obſervations on* Virginia.

BEing honour'd with the Thanks of the Society for my laſt, and receiving by my worthy Friend Dr. *Moulin* their Commands to proceed, I have added here my Obſervations of the Waters, and part of the Earth and Soil. I ſhall wave both Complements and Apologies, ſince I have greater Reſpect and Honour for the Society than I can poſſibly expreſs, and have no reaſon to ſuſpect their Favour, whoſe Candidneſs I ſo ſignally proved in my laſt.

Of the Waters.

'TTwixt the two Capes, the Southern, call'd the *Cape Henry*, the more Northerly call'd *Cape Charles*, there runs up a great Bay, call'd the Bay of *Cheeſepeak*; Nine Leagues over in ſome places, in moſt Seven, lying much Weſt, Nore and South, dividing *Virginia* into two unequal parts. On the Eaſt ſide of this Bay there lies a narrow Neck of Land, which makes the Counties of *Northampton* and *Accomack.* On the Weſt ſide of the Bay there branches forth four great Rivers, *James River*, *York River*, *Rapahanack* and *Potomack*, that riſe from a Ridge of Mountains, whereof more in the Sequel. Theſe Rivers plentifully water all the other parts of *Virginia*, emptying themſelves into the great Bay. The Mouth of *James River*, which is the moſt Southerly of them, to the Mouth of *Potomack*, which is the moſt Northerly, may be a hundred Miles diſtance: But as I have been credibly inform'd, that the Falls of *James River* are not paſt Thirty Miles from *Potomack*, which is a vaſt large River Nine Miles over in many places. I have been told it was Navigable nigh Two Hundred Miles, much higher than any of the other Rivers: Whence I conclude in future times, it will be the moſt conſiderable for Trade when the Country comes to be inhabited further up into the main Land. The other Rivers are much about Three Miles over apiece. And *James River* is Navigable at leaſt Eighty Miles. Within Four or Five Miles of *James Town*, *James River* and *York River* are not paſt Four or Five Miles aſunder. Yea, Sloops of conſiderable Carriage may Sail up the Branches of the two Rivers, till they come within a Mile the one of the other; for I take it to be no more from Col. *Bollard*'s to Major *Troop*'s Landing; and I believe they may come much what as near again as Col. *Coles*, and ſeveral other places. *York River* is diſtant from *Rapahanack* in ſome places not paſt Ten or Twelve Miles, *Rapanack* from *Potomack* not paſt Seven Miles in one place, tho' it may be Sixty in others. The Heads of the Branches of the Rivers interfere and lock one within another, which I think is beſt expreſſed after the manner that an *Indian* explained himſelf once to me, when I enquired how nigh the Rivers of *Carolina*, *Virginia* and *Maryland* aroſe out of the Mountains, from thoſe that ran Weſterly on the other ſide of the Mountains, he clapt the Fingers of one Hand 'twixt thoſe of the other, crying, they meet thus; the Branches of different Rivers riſing not paſt a hundred Paces diſtant one from another: So that no Country in the World can be more curiouſly watered. But this Conveniency, that in future times may make her like the *Netherlands*, the richeſt place in all *America*, at the preſent I look on the greateſt Impediment to the Advance of the Country, as it is the greateſt Obſtacle to Trade and Commerce. For the great number of Rivers and the thinneſs of the Inhabitants diſtract and diſperſe a Trade. So that all Ships in general

gather

gather each their Loading up and down an hundred Miles diſtant; and the beſt of Trade that can be driven is only a ſort of *Scotch* Pedling; for they muſt carry all ſort of Truck that trade thither, having one Commodity to paſs off another. This (*i e*) the number of Rivers, is one of the chief Reaſons why they have no Towns; for every one being more ſollicitous for a private Intereſt and Conveniency, than for a publick, they will either be for making Forty Towns at once, that is, two in every County, or none at all, which is the Countries Ruine. But to return, The Tides in theſe Rivers regularly ebb and flow about two foot perpendicular at *James Town*; there is there, as they call it, a Tide and half Tide, that is, it flows near two hours along by the Shoar, after that it is Ebb in the Channel, and again it ebbs near two Hours by the Shore, after that it is Flood in the Channel. This is great advantage to the Boats paſſing up and down the River. I ſuppoſe this is cauſed by many Creeks and Branches of the Rivers, which being conſiderable many, tho' only three or four Miles long, yet as broad as the *Thames* at *London*; others Ten Miles long, ſome above Twenty, that have little freſh Water which they carry of their own, but their Current primarily depending upon the Flux and Reflux of the Sea. So that after the Tide is made in the Channel, it flows by the Shoar a conſiderable time afterwards, being that thoſe Creeks are ſtill to fill, and therefore as it were draws a Source upwards by the Shoar; and likewiſe when the Tide returns in the Channel, the Creeks that could not ſo readily disburſe their Water, being ſtill to empty themſelves, they make an ebbing by the Shoar a conſiderable time after that it is Flood, as I ſay, in the Channel. So far as the Salt Waters reach the Country is deemed leſs healthy. In the Freſhes they more rarely are troubled with the Seaſonings, and thoſe Endemical Diſtempers about *September* and *October*. This being very remarkable, I refer the Reaſon to the more piercing Genius of thoſe moſt judicious Members of the Society: And it might perhaps be worthy the Diſquiſition of the moſt Learned to give an Account of the various Alterations and fatal Effects that the Air has on humane Bodies, eſpecially when impregnated with a Marine Salt; more peculiarly when ſuch an Air becomes ſtagnant: This might perhaps make ſeveral beneficial Diſcoveries, not only in relation to thoſe Diſtempers in *America*, but perhaps take in your *Kentiſh* Agues, and many others remarkable enough in our own Nation. I lately was making ſome Obſervations of this Nature on a Lady of a delicate Conſtitution, who living in a clear Air, and removing towards the Sea-Coaſt, was lamentably afflicted therewith, which both my ſelf and others attributed to this Cauſe, ſhe having formerly upon her going to the ſame been ſeized in the ſame manner. But to return: There is one thing more in reference to this very thing very remarkable in *Virginia*, generally twice in the year, Spring and Fall, at certain Spring Tides, the moſt of the Cattle will ſet on gadding, and run, tho' it be twenty or thirty Miles, to the River to drink the Salt Water, at which time there's ſcarce any ſtopping of them; which the People know ſo well, that if about thoſe times their Heards are ſtray'd from their Plantations, without more ſollicitation they go directly to the Rivers to fetch them home again. As for the Waters in the Springs in general, they are, I think, ſomewhat more eager than thoſe in *England*. In that I have obſerved, they require ſome quantity more of Mault to make ſtrong Beer than our Engliſh Waters, and will not bear Soap. I have try'd ſeveral by infuſing of Galls, and found little difference in the Colours, turning much what the Colour of common Sack in Taverns. I tried two Wells at Col. *Bird*'s, by the Falls of *James River*, ſeveral Wells near *James Town*, ſome Springs in the *Iſle* of *Wight County*: There's a Spring in the *Iſle of Wight* or *Nanzamond County* vents the greateſt Source of Water I ever ſaw, excepting *Holy Well* in *Wales*, but I had not opportunity to make experiments thereof. I tried likewiſe ſome Springs on the Banks of *York River*, in *New Kent* and *Glouceſter County*, but found them vary very little as to Colour. I could not trie any thing as to their ſpecifick Gravity, having neither Aquapoiſe, nor thoſe other Glaſſes I had contrived peculiarly for making ſuch Experiments, they being all loſt with my other things. I had Glaſſes blown would hold about Five Ounces, others about Ten Ounces, with Necks ſo ſmall, that a Drop would make a conſiderable Variation; with theſe I could make much more critical and ſatisfactory Obſervations as to the ſpecifical Gravity of Liquors, having Critical Scales, than by any other way yet by me tried. I uſed this method to weigh Urines, which Practice I would recommend to the inquiſitive and critical Phyſicians. I had made many Obſervations hereof, but all Notes were likewiſe loſt with my other things. Yet I have begun afreſh; for there are more ſignal Variations in the Weights of Urines than one would at firſt imagine; and when the Eye can diſcover little, but judge two Urines to be alike, they may be found to differ very much as to Weight. By Weight I find Obſervations may be made of Affections in the Head, which rarely make any viſible Alterations in the Urine. I have found two Urines not much unlike differ two and twenty Grains in the quantity of about four or five Ounces: But let them that make theſe Eſſays weigh all their Urines when cold, leſt they be thereby deceiv'd. But to return to the Spring Waters in *Virginia*. There's a Spring at my Lady *Berkley*'s, called *Green-Spring*, whereof I have been often told, ſo very cold, that 'tis dangerous drinking thereof in Summer-time, it having proved of fatal Conſequence to ſeveral. I never tried any thing of what nature it is of.

There be many petreſying Waters; and indeed I believe few of the Waters but participate of a petreſying quality, tho' there be few Pebbles or paving Stones to be found in all the Country. But I have found many Sticks with cruſty Congelations round them in the Runs of Springs, and Stones ſigured like Honey-combs, with many little Stars as it were ſhot in the Holes. And nothing is more common than petreſy'd Shells, unleſs you would determine that they are parts of natural Rock ſhot in thoſe Figures, which indeed I rather think; but thereof hereafter. Mr. Secretary *Spencer* has told me of ſome Waters participating much of *Alome* or *Vitriol* towards *Potomack.* Up beyond the Falls of *Rapahanack* I have heard of Poyſonous Waters. But theſe I only mention as a Hint to further Enquiry of ſome others, for I can ſay nothing of them my ſelf.

The remainder of this Letter being his Obſervations on the Earth and Soil of Virginia *ſhall be reſerved for the next Tranſaction.*

IV. An Account of a BOOK.

An Account of Dr. Burnet*'s Book, Entituled*, ARCHEOLOGIÆ Philoſophicæ, ſive Doctrina Antiqua de Rerum Originibus. Libri duo. *Londini*, Typis *R. N.* Impenſis *Gualteri Kettilby* ad Inſigne Capitis Epiſcopi in Cœmeterio Paulino. 1692.

IN this Treatiſe he endeavours to diſcover what were the Sentiments of the Ancients concerning the Origin or beginnings of this viſible World, of which he conceives Men in all Ages have had a true, if not a Divine Knowledge, as well as of a Divine Power, and of the intermediate Order, Viciſſitudes and Ends of all things. And that *Pythagoras* was not the Inventor of the Mundan Syſtem aſcribed to him, but the Conveyer only of it from the Orientals, ἀπόρρητα, to the *Grecian* Schools, where yet it received leſſer Improvement as to particular Explications, then it has by the Modern Inquiſitions, (as he conceives) though yet he grants that our Hiſtories of their Opinions are very imperfect, yet as the Magnificence of a Structure may be judged of by its Ruines, ſo in general we may have ſome Idea of their Doctrines by the Fragments of them which are yet to be found in the *Grecian* Writers, as well Hiſtorical as Fabulous, or Muthical and Poetical. By all which he endeavours to prove, that moſt of the Ancients held very much the ſame Notion concerning the beginning of things with that delivered by *Moſes* in the beginning of his Writings, with which, he conceives, alſo that his already publiſh'd Theory is conſonant. It was his Deſign alſo to have written a general Body of Philoſophy, but the ſenſe of his Age and approaching Death ſeems to have made him deſiſt, and to ſatisfie himſelf with what he hath hitherto performed in the preceding Books, and in this which he ſeems to make the Seal and Conſummation of the former.

He divides the whole Diſcourſe into two Books. In the firſt he endeavours to diſcover what were the moſt antient Doctrines of all Nations concerning the beginnings of things, in general. But in the Second he endeavour'd to collect all ſuch Paſſages amongſt them as ſeemed moſt conſonant to, and confirming of the Doctrines delivered in the firſt part of his Theory where he had omitted taking notice of them, though in the Second Part he hath intermixed them with the Theory throughout, which therefore did not need any ſuch a Supplement.

In the Firſt Chapter he enquires whence this Knowledge is to be fetcht, which he conceives to be all from the Poſtdiluvian Records, which were all conveyed by *Noah* from the Antidiluvian, and diſperſed amongſt his Poſterity. Next he enquires where any Footſteps are to be found of it among theſe. And ſince he finds the Ancients divided the Nations of the World into Four Heads, comprehending the whole Race of Mankind, to wit, the *Scythians* towards the North, the *Celti* towards the Weſt, the *Æthiopians* towards the South, and the *Indians* towards the Eaſt. He follows the ſame Order in his Enquiry. And amongſt the firſt he finds no ancient Footſteps of their Philoſophy, and doubts whether ever they had any: Tho' *Abaris* is ſaid by *Suidas* to have written a *Theogonia*; and a Septentrional Mythology hath been of late publiſhed, ſavouring much of Antiquity.

Amongſt the *Celti* he finds Philoſophy to have been all along, *viz.* among the *Druids* and *Semnothei*; of whom yet we have but a dark Account, that they profeſs'd to underſtand the Order and Motions of the Heavens, and the Will of the Gods; and that *Strabo* ſays, they taught the Worlds Periods by Water and Fire, and held a tranſmigration of Souls, as the *Pythagoreans*; tho' they are thought to have much preceded him, and to have been the moſt ancient for Mythologick Theology. Of this Claſs were what Philoſophers were to be found anciently among the *Germans*, *Britains*, *Spaniards* and *Italians*; of ſome of which *Strabo* affirms, that they had Poems of their Laws, *&c.* of 6000 years ſtanding. Thoſe among the *Hetruſci*, *Diodorus Siculus* ſays, ſtudied Philoſophy: And *Plutarch* ſays, they had the Notion of the *Annus Magnus*, or Periods of Revolutions, and that the *Romans* had their Sacred Rites from them.

Among the *Æthiopians* the *Gymnoſophiſts* were famous; but we can find very little information what their Philoſophy was. They were Celebrated indeed for their Laws, Government and Converſe with the Gods, and had a very ancient uſe of Letters; and had Colledges of Prieſts which taught Philoſophy and Theology. Theſe are ſaid by *Lucian* to have been the firſt Aſtronomers, and to have taught the *Ægyptians*. But as to the Theory of the Earth, there is nothing of theirs to be found. And indeed, moſt of the Ancient Authors that writ purpoſely of them are now no more to be found.

Having paſs'd over theſe three Heads without making much Diſcovery to his purpoſe, he in the Third Chapter comes to the *Orientals* or *Indians*, comprehending all the *Aſians*; and ſome of their Neighbours, as the *Ægyptians* and *Greeks*. He begins then with the moſt Eaſtern Nation, the *Seri* or *Chineſes*. *Celſus* and *Dionyſius* call them Atheiſts, becauſe they had no Idol-Temples or Worſhip; and Barbarians, becauſe they had no Commerce with other Nations. So that it ſeems little of their Learning was known to the Ancients; though of late years they have been much better known, to have very ancient Hiſtories, and ſome that mention the Flood and the beginnings of things. But by what we can learn, their Phyſiology is much inferiour to what was known in the Weſtern Parts, as was alſo their Mathematicks, being all of their own Production, and not borrowed from any beſides. Contrary to that of the *Greeks*, *Romans*, and other *Europeans*, who derived all from others. Paſſing from theſe to the South, he meets with the *Brachmans*, Philoſophers celebrated in all Ages for their Devoting themſelves wholly to Contemplations, of unknown Original, but yet worthy to be more diligently enquired into, both for their Eminency in Phyſiology and Aſtronomy, though both were wrapped up and vailed under Mythology: Yet they had ſome Notions concordant with the *Greek*. *Strabo* alſo ſays, That they held the World to have been generated, and was corruptible; That it was form'd out of Water, but the reſt of the Univerſe from other Principles. The chief of theſe were moſt honoured, and abſolutely free, neither Governing, nor Governed by any. This is the Sum of what can be found amongſt the Ancients concerning their Natural Philoſophy.

In the Fourth Chapter he enquires concerning the *Aſſyrians* and *Babylonians*, who were the firſt Empire after the Flood: Theſe are accounted the firſt who cultivated Literature and had Publick Schools at *Babylon*, which continued ſo till the time of *Nebuchadonozer* and *Daniel*. Theſe Learned Men were call'd *Chaldeans* and *Magi*; and the chief of them were Phyſiologers and Aſtronomers, and ſtudied lawful Arts, as may well be concluded; for that *Daniel* accepted the Prefecture of them: Theſe excluded the Aſtrologians and Diviners from their Habitations. To theſe *Pythagoras* reſorted to learn the Motions of the Heavens, and the Original of the World, ſaith *Juſtine.* Κοσμοσύςασιν and κωσμογήνειαν. Theſe were then under the *Perſians*, but the remainders of the *Chaldeans* and *Babylonians*. However, nothing is left of their Opinions but what *Diodorus* has hinted, That they believed the Matter of the World Eternal, but its Form, Order and Ornament to be conſtituted by Divine Providence. And further, That they believed the Earth to be of the Form of a Schiff or Tray: Only he ſpeaks of their Antiquity, and of making Aſtronomical Obſervations many Ages before *Alexander.* This is all that is intelligible: All the reſt concerning their Oracles of *Ziroaſter*, &c. is nothing but Canting, and a Jargon of Scraps of we know not who. 'Tis pity we have loſt the Works of *Beroſus*, who had written their Opinions.

In the Fifth Chapter he ſpeaks of the *Perſian Magi*, who cultivated Phyſiology as well as Theology. Theſe had a *Theogonia* like the *Greeks*; and from theſe *Pythagoras* learnt the Origin of the World, and the Motions of the Heavens. Theſe taught likewiſe the Periods and Renovation of the World. The Prince of theſe *Magi* was *Zoroaſter*, of which he judges there were two. The *Perſians* held the Elements, Stars and the Heavens to be Gods; and worſhipped moſt the Sun among the Stars, and the Fire among the Elements: And under the Nature of *Jupiter* they comprehended the whole Circuit of Heaven. They, as well as the *Greeks*, *Romans* and *Hebrews*, continually nouriſh'd the Fire. And the *Egyptians* as well as other Nations much honoured it. The *Perſians* ſuppoſed this Fire to have fallen from Heaven; and the Stoicks call'd it *Jupiter*, into which all things reſolved. Thus their Theology was Phyſeology, and all their other Rites may be in the ſame manner reſolved; of which *Herodotus* has given a plain Account: In which he particularly takes notice, that in their Sacrificing they ſung their *Theogonia*, which our Author conceives to be of the Origination of things. Of *Zoroaſter*, *Pliny* relates that he left Two Millions of Verſes, expounded by *Hermippus.* The *Arabians* mention Twelve Volumes, each filling a whole Bulls Hide of the Writings of *Zoroaſter* to be left to the *Magi.* *Suidas* mentions divers Books of the ſame, concerning Dreams and Aſtronomical Productions, and Four Books of Natural Philoſophy; but all are loſt; and what goes under his Name are all Fictitious, except one Fragment preſerved by *Plutarch* out of *Theopompus*; another by *Porphyrius* in *Antro Nympharum*, out of *Eubulus*; and a third by *Euſebius*, out of a *Perſian* Book, which he will have *Zoroaſter*'s. As the beginning of theſe *Magi* was unknown, ſo was their end; yet ſome remained to the time of *Alexander*; and 'tis believed they fell with the *Perſian* Empire; and all that had been written concerning them is alſo periſh'd. Such were *Hermippus Smyrnæus*, *Pallas*, *Oſthanes*, *Eubulus*, *Theodorus Mopſueſtenus*, *Hermodorus Platonicus*, *Anteſthenes* or *Rhodonis*, *Zanthus Lydus*, *Sotiones*, *Dinon*, *Theopompus*, *Eudemus Rhodius*, and *Clearchus Solenſis.*

In the Sixth Chapter he enquires after what is to be met with among the *Arabians* and *Phœnicians*. The Firſt is *Job*, whom he makes an *Arabian*, before the time of *Moſes*, who had the knowledge of Letters, and of the Heavens, and many other parts of the Creation, beſides that of the Worſhip of the true God. This Knowledge laſted to the time of *Solomon*, as appears by the Queen of *Sheba*: Nay, till the Birth of Chriſt, as appears by the *Magi* that came to Worſhip him. The *Zabii* he makes to be ſome of the ancient *Arabs*, among whom *Abraham* was bred. Theſe boaſt of having the Religion of *Noah*. To theſe, *Porphyry* ſays, *Pythagoras* went: And *Pliny* affirms the ſame of *Democritus*: But theſe ſince that time have degenerated, and have taken up the *Grecian* Learning; though they had alſo tranſlated into their Language the Ancient Learning of the *Egyptians*, *Perſians* and *Chaldeans*; but theſe were burnt by the *Saraꝫens*. What Writings yet remain among them are thought not older than Eight or Nine Hundred Years. The *Dahretes* among the ancient *Arabs* held the World Eternal, and the Soul mortal. Hence their Proverb, *Uteri pariunt*, *Sepulchra deglutiunt*, The Womb makes, the Tomb takes. Next for the *Phœnicians*, he finds them very ancient, and early knowing in Letters, Arithmetick, Aſtronomy, Phyſiology, Navigation, Foreign Trade and Planting. *Thales* and *Zeno* were *Phœnicians*, and to them went divers of the *Greek* Philoſophers. *Stabo* ſays, that *Moſchus* found the Hypotheſis of *Atomes* before the *Trojan* War. The Philoſophy before the *Trojan* War was all by Tradition, but after that came in the Rational and Diſputative. Nothing remains of *Sanchoniathon*'s Philoſophy, but that he had ſtudied the *Koſmogonian* of *Taautes*, deducing the World from the ancient Chaos, and a precedent Ιλὺν or Matter. He wrote alſo divers other Philoſophical things; but they, as well as all the other Authors that wrote of the *Phœnicians*, as *Theodotus Hypſicrates* and *Mochus*, *Heſtieus*, and *Hieronimus Egyptius* are wholly loſt.

In the Seventh Chapter he enquires what Footſteps of ancient Phyſical Learning is to be met with among the *Hebrews*, and in their *Cabala*. Firſt he notes, that *Lactantius* wonder'd why *Pythagoras* and *Plato* went to the *Egyptians* for Knowledge, but not to the *Hebrews*; which is an Argument they were not then conſiderable for that kind of Knowledge; that is, Phyſical and Mathematical. What they had was contained in their *Cabala*, which they pretend to have received from *Moſes*. But whatever it were at firſt, it hath been much depraved with Rabbinical Figments and Chimera's: Such are the Myſtical Numeration by the Letters of Words; ſuch are the Magical Spells derived alſo thence; ſuch the expreſſing common Notions by a ſort of Myſtical Words, or Characters, or Numbers, to make it more wonderful to ſuch as do not underſtand it. Which was a trick made uſe of alſo by *Pythagoras* in his Symbols, by the *Egyptians* in their Hieroglophicks, and by the *Hermeticks* in their Cant: All which, if the Veil were removed, would appear empty Nothings, being of no other uſe, but to amuſe the Ignorant and conceal their own Defects and Emptineſs. They divided their *Cabala* into Nominal and Real. The Nominal was Triple, *Gemmatria*, *Notaricon*, and *Themmura*, plainly Modern and Barbarous Names. All conſiſted in ſhuffling the Letters of Words mixed with Number. *Reuclin* yet ſays, that the *Jews* affirm, that thereby may be found out all the Knowledge of *Moſes* and *Solomon*, as well Divine as Humane, and that *Solomon* himſelf received all his Knowledge thereby.

The real *Cabala* they make Two-fold, *i. e.* The Doctrine of *Sephiroth*, and the Doctrine of the Four Worlds. They make 10. Cabaliſtick *Sephiroth*, *viz.* the Crown. 2. Wiſdom. 3. Prudence. 4. Magnificence. 5. Severity. 6. Pulchritude. 7. Victory. 8. Glory. 9. Foundation. 10. Kingdom, by which what they mean the Author underſtands not. They pretend they are Emanations from God, and that they are Numbers emanating from the Infinite Verity. He ſpends ſome time in examining each, and their branchings out into divers other Subdiviſions. But upon the whole he concludes, That the further he proceeds the more Obſcurity and Confuſion he meets with. Next he examines the Doctrine of the Four Worlds, to wit, *Azilath*, *Briah*, *Jetzirah*, *Aſhiah*, i. e. the Worlds of Emanation, Creation, Formation and of the Fabrick; before all which they put the *Enſophick*, or Infinite World, from which all the other do ſpring. Upon a more deligent Enquiry into the Contents of theſe myſtick Doctrines the Author ſeems to think them all Cheats, and concludes with the Words of Chriſt, *Men love Darkneſs rather than Light, becauſe their Deeds are evil.* Every one that doth Evil hateth the Light, leſt he ſhould be diſcovered; but he that doth Truth, cometh to the Light, that his Deeds may be manifeſt; ſuſpecting all thoſe affected Obſcurities to be deviſed by them to conceal nothing elſe but their own Ignorance and Deceit. The Author proceeds further with examining other parts of the *Cabala*: But upon the whole he finds nothing rational, or containing any real Knowledge. But he conjectures, that the moſt ancient *Cabala*, before it was confounded and defiled with Fables, might contain ſomewhat of the Origination of things, and their Gradations; but as it has been in time chang'd and augmented by imaginary Fables, and blinded with impertinent and nonſenſical Explications, it is now become a confuſed Maſs of Incongruities and Abſurdities. But by examining theſe Dregs, he conceives that the Ancients might hold, That before the Creation all things had their being in God; and that from him they flowed or emanated when firſt made, and that they will all flow back into him when they are deſtroyed, which he conceives was alſo the Opinion of the moſt Ancient Philoſophers; and that there would ſucceed other Emanations and Regenerations, and other ſucceeding Deſtructions and Obſorptions to all Eternity, as it had been from all Eternity; that Nothing was produced out of Nothing; and that the things produced never return to Nothing, but always have their Subſiſtence in God. Which Sence, if it doth not contain, he conceives it may be look'd upon as Salt that hath loſt its Savour, which is good for nought, but to be thrown out of Doors. But if it contains any ſolid Knowledge, it ought to be manifeſted or condemned otherwiſe to perpetual Darkneſs. But leſt it might deceive the Ignorant, he cautions them to be lead by no Authority that is not Divine, nor by any Reaſon that is not clear and manifeſt. Before he leaves this Head, he enquires concerning the *Eſſeni*, a Sect among the Jews, not unlike in their Manners to the *Indian Brachmans*. All that theſe had of Philoſophy, ſays *Philo*, was of God, and of the Generation of things: But what that Knowledge was does not appear; but he conceives it is to be learnt from the *Brachmans*, with whom they agreed.

From theſe he paſſes on (in the Eighth Chapter) in his Search for the ancient Learning amongſt the *Egyptians*, where he finds it very ancient, and much celebrated by the *Hebrews*, who extol both *Moſes* and *Solomon*, the one for knowing, the other for excelling it; and by the *Greeks*, as from whence they had derived their Knowledge. Upon a ſtricter Enquiry into it, he finds it to be firſt Geometry, as old as the overflowing of the *Nile*, upon which account it was invented; but he thinks they were but Land Meters; and that the *Greeks*, as *Thales* and *Pythagoras* did make it Speculative. 2. Aſtronomy. But this the *Chaldeans* knew; nor doth it appear which were the firſt; but he conceives both were very ancient, but rude and imperfect, and much improved afterwards by the *Greeks*. However, he believes they had a true Knowledge of the Syſtem of the Heavens, and underſtood the Motions of the Planets, *&c.* Yet he thinks that they did not underſtand them ſo well, as to reduce their Motions to Calculation. They are ſaid alſo to have cultivated Muſick and Phyſick, but theſe alſo without Theories, and only by Tradition. And tho *Herodotus* ſays, they had for every Diſeaſe a particular Phyſician: Yet both theſe were much more improved by the *Greeks*. They are ſaid by others to be the Inventers of Chimiſtry. Laſtly, That they were knowing in Phyſicks or Natural Science; that is, the *Coſmogonia*, *Theogonia*, or *Theologia*, which they look'd upon as the ſame Science. They held the Earth to be formed out of the confuſed Maſs of the Four Elements, or out of the Chaos; and a two-fold Deſtruction of it one by Fire, another by Water; That the Earth was of an Egg form; and that we call the *Pythagorick* Syſtem was the oldeſt of all others, but kept among their *Arcana*. Their moſt Celebrated Philoſopher was *Hermes Triſmegiſtus*; though when he lived, or what he thought and writ is not known. Thoſe that bear his Name are fictitious. But among the multitude of his Writings, his *Coſmologia*, mentioned by *Philo Biblius*, is loſt. The *Egyptians* preſerved their Learning by their Prieſts, who had Colledges in divers parts of *Egypt*. They had it inſcribed on Obeliſks, and written in Books. The *Babylonians* had Cœleſtial Obſervations for 720 Years inſcribed on burnt Tyles. *Democritus* tranſcribed his Morals from a *Babylonian* Column. The Columns of *Hermes* in *Egypt* are famous, on which were inſcribed his Doctrine. From theſe the *Greeks* and *Phœnicians* had much of their Knowledge, and *Manetho* his Sacred Hiſtory. *Amianus Marcellinus* ſays, theſe Columns were placed in ſubterraneous Vaults, and were there before the Flood. *Manetho* and *Joſephus* aſſert the ſame of theirs, both poſſibly the ſame. In their Books were written their Laws, their Hiſtory and their Philoſophy. Some things were communicable, others were *Arcana*, not to be devulged. They had alſo a two-fold way of Writing, one Common, another Sacred. This was written with *Hieroglyphicks*. The *Brachmans* have not only a different Character, but a different Language to preſerve their Philoſophy. Theſe Prieſts were ſtrict Concealers of their Secrets, as many Authors complain of them. Nor was *Pythagoras* admitted without being firſt Circumciſed, and otherwiſe qualified. The *Eſſeni*, and others of other Nations, as *Perſians*, *Syrians*, and *Indians*, adminiſtred Oaths, *&c.* of Secrecy. They further obſcured their Knowledge by Symbols, Ænigma's and Fables, in which the *Greeks* alſo follow'd them, as did alſo moſt other Nations in the Hiſtories of their Gods, of which kind he gives divers Inſtances. Among theſe are the Mythologies of the Prophets in the Old Teſtament, and the Parables of Chriſt in the New. This Mythologick Genius *Saluſtius* calls Divine ; and 'tis plain Myhologies were made uſe of by the Ancients to conceal their knowledge from the Vulgar, and yet preſerve it ſafe for the Learned. Nay, Divine Providence doth ſo conceal both Divine and Natural Knowledge, that this or that part becomes known to this or that Man in one Age, which hath lain abſconded to all preceding. This Mythologick was the moſt ancient Learning among the *Greeks*, as he proves by ſeveral Teſtimonies; yet was it firſt received from the *Egyptians.* This cauſes him to enquire whether the Works of *Hermes* were ſo writ, and he finds by a place quoted by *Euſebius*, that they were firſt written plain, then turned by the Son of *Thabion* into Allegories, and then tranſcribed into *Greek*. So that plain Writing was before Mythologick ; and 'tis probable thoſe that have it Mythologically, had it before pure ; and that the Additions that have been added to the firſt Fables, have obſcured, if not quite obliterated the concealed Senſe. He propounds and anſwers two Objections, by which he ſhews the Inconſiſtency of Men's Actions with their Knowledge, and ſo Apologizes for the *Egyptian* Idolatry, and their Aſtrologick and Magick Practices. Laſt of all, he enquires how the *Egyptians* came to loſe this Learned State they had kept for ſo many Ages, which he ſhews to have proceeded from their being conquered and overun by divers Nations ; as by the *Perſians* under *Cambiſes*, and ſome ſucceeding Kings, by whom it began to decay. And by the *Romans*, who burnt the *Alexandrian* Library, with which their Learning was alſo much deſtroyed ; and by the Conqueſt of the *Saracens* totally extinguiſhed. Amongſt the loſt Hiſtorians of the *Egyptian* Learning, *Manatho* was the chiefeſt, as appears by Teſtimonies now extant, next *Sanchoniathon*, then *Aſclepiades*, *Petoſiris*, *Hecateus* , *Palæphatus*, and *Chæremon*, and many others. Theſe are Loſſes, but nothing to be named with the loſs of the Library of *Ptolomeus Philadelphus*, wherein many Myriads periſhed in a moment, containing the Sum of all *Egyptian*, nay, and all Oriental Learning too, in all probability.

In the Ninth Chapter he enquires concerning the *Græcian* Philoſophy, of which, that he may the more fully give you the Hiſtory, he produces ſufficient Proof to ſhew it derived from the *Egyptian* ; not that he denies the *Grecians* to have much improved ſeveral parts thereof: That they learn'd their Geometry, Aſtronomy and Arithmetick from the *Egyptians*, *Chaldeans*, and *Phœnicians*, *Herodotus*, *Plato*, *Ariſtotle*, *Diodorus*, *Strabo*, *Laertius*, *Achilles Tatius*, and others their own Authors do teſtifie. 'Tis ſaid, *Semiramis*, who lived Eight Hundred Years before the *Trojan* War, built a high Tower in *Babylon*, on the top of which the Aſtronomers made their Obſervations, at which times the *Greeks* had not the uſe of Letters. Moreover, *Caliſthenes* ſent into *Greece* from *Babylon* Celeſtial Oſervations for 1900 Years before *Alexander*'s time. And *Epigenes* found Obſervations at *Babylon* for 720 years, and others were brought of 480, as *Pliny* relates ; theſe were inſcribed on baked Bricks : Whereas the *Greek* Obſervations began with *Hipparchus* and *Ptolomy*. Yet though the Hiſtories were furniſh'd by the *Barbari* , the reaſons of their Motions were invented by the *Greeks*. But though they improved the Mathematick Arts, yet they vitiated the Phyſicks, which they alſo received from them. That the *Greeks* had theſe from the *Barbari*, *Clemens Alexandrinus* and *Euſebius* both teſtifie ; as doth alſo *Porphyrius* and *Joſephus*,

ſephus, and *Diodorus Siculus*, who affirm the *Greeks* moſt eminent for this Learning. As *Orpheus*, *Thales*, *Pherecides*, *Pythagoras*, *Solon*, *Plato*, *Eudoxus*, all fetcht it either from the *Egyptians* or *Phœnicians*. Nay, the very knowledge of Letters was firſt brought into *Greece* by *Cadmus* not long before the *Trojan* War. Whereas Learning flouriſh'd in *Aſſyria*, *Egypt*, *Phœnicia*, *Arabia*, *Ethiopia*, *India*, and among the *Celti* long before that time. There were two ſtates of *Grecian* Philoſophy. The firſt, which was the oldeſt, moſt of which was wrote in Verſe, treated of the *Coſmogonia*, or Origination of things, by *Thamyras*, *Linus*, *Orpheus*, *Muſeus*, *Heſiod*. Alſo *Thales*, *Zenophanes*, *Empedocles*, *Parmenides*, and ſome others, whoſe Fragments are collected by *Steevins* in his *Poeſis Philoſophica:* All which Poetick Writers did mythologize the *Coſmogonia*, *Homer* only excepted. This the Author proves by ſeveral Teſtimonies; and adds, That *Orpheus* was the firſt that brought Learning into *Greece*; that aſſerted the Oval Form of the Earth, the Form the Author aſſigns to his Antidiluvian Earth: That he lived not long after the time of *Moſes*, and was the Founder of the *Grecian* Theology, as *Moſes* of the *Hebrew*; and that both accommodated the Ceremonies to the Capacity of their reſpective People. That is, *Orpheus* inſtituted ſuch a Religion as he could, not what he would, wanting the Divine Aſſiſtance of Miracles which *Moſes* had. He was feign to make uſe of Muſick and pleaſing Mythologick Stories to allure his People from Barbarity to Government and Society. For which purpoſe it was of very great benefit, and generally made uſe of not only by Poets, but Legiſlators and Phyſiologers. *Orpheus* excelled in all theſe, and firſt taught the *Grecians* Religion, and the Rewards and Puniſhments of another Life, which he proves by Heathen and Chriſtian Teſtimonies. But among theſe muſt be diſtinguiſhed what he taught the Vulgar from what was his Secret Doctrine, for that he had both the δημώδη ϗ ἀπόῤῥητον· *Suidas* ſays, he held the Heavens to be formed of the *Æther*, and the Earth out of the Chaos, before which he placed Time as the meaſure, but he makes them both coeval; whereas others of the Ancients ſeparate them by a multitude of Ages. *Empedocles* makes all the Stars to be Fires, but *Orpheus* to be Worlds; the Author ſuppoſes the Planets were meant. As the Moon was therefore called ἀντίχθον, which *Orpheus* firſt aſſerted Habitable, proved by *Proclus*, as alſo that the Oval Earth was to be deſtroyed by Fire, and then to be renewed. Before he leaves this Head, he anſwers the Objections of *Cicero*, and more eſpecially *Gerard Voſſius*, who would perſwade that there never was any ſuch Men as *Orpheus*, *Muſeus* or *Linus*, whoſe Arguments the Author thinks no ways cogent or to be regarded, ſince there are ſo many poſitive Proofs to the contrary both in Heathen and Chriſtian Writers.

In the Tenth Chapter he enquires among the *Greek* Philoſophers that ſucceeded *Orpheus*: And firſt amongſt the *Ionicks*. Theſe are the Second kind of Phyſiologers, who wrote expreſly and in Proſe, not in Verſe and Mythology, as the former. Theſe were *Thales* and his Ionicks, *Pherecydes*, *Pythagoras*, *Zenophanes*, *Parmenides*, *Leucippus*, *Democritus*, *Empedocles*, *Plato*, and others, to *Epicurus* and *Ariſtotle*, in whom ended Philoſophick Antiquity; except ſome Fragments among the *Stoicks*. *Thales* was a *Phœnician*, but received his Knowledge from *Egypt*, and was famous for *Geometry*, *Aſtronomy* and *Phyſick*, and aſſerted the Immortality of the Soul; and firſt writ a Diſcourſe of Phyſicks, without Mythology or Theology. Nothing of his Aſſertion ſertions remains but only that all things were generated out of Water. Which is agreeable to St. *Peter* and *Moſes.* Poſſibly more particulars of his Doctrine may be found among his Followers, *Anaximander*, *Anaximenes*, *Anaxagoras*, *Archelaus*. *Anaxagoras* then makes a mind to Regulate Matter, and move it, and was therefore called Νȣ̃ς. He ranges the four Elements by Gravity, and is ſaid to have Introduced Vortices. As for the Heavens, the *Ionians* much promoted the Knowledge of them; *i. e.* They held the Heavenly Spaces to be Æther; the Stars, Fire; the Planets opaque Bodies: That the Moon had Hills and Vales, and was Habitable, and that it was enlightned by the Sun, which was a moſt pure Fire. He held alſo the Rotation of the Earth, as alſo the Annual Motion about the middle of the World, as *Theon Smyrneus* affirms. To ſhew the Reaſon why it is ſo difficult to find what were their true thoughts, He quotes this Paſſage of *Plutarch*. This Doctrine (that is, concerning the Heavens) was not celebrated and famous, but hidden and kept ſecret, and it was diſcourſed of with great Caution among a few under an Oath of Secrecy; for Philoſophiſings concerning the Heavens would not be endured, becauſe thoſe ſeemed to reſtrain and bind up the Divine *Numen* to Cauſes without Reaſon, and to blind Powers, and to involuntary Effects; upon which Account *Protagoras* was baniſhed, and *Anaxagoras* put in Irons. *Socrates* alſo for the Name of a Philoſopher was put to Death. Whence the Author obſerves, that in all Ages it has been very dangerous for Philoſophers to ſpeak plain Truth amongſt the Vulgar.

In the Eleventh Chapter he enquires concerning the Doctrine of *Pythagoras* and the *Italic* Philoſophy, where he finds that either *Pythagoras* wrote nothing, or if he did, even the Hiſtory of them is loſt: So that nothing of his Phyſiology is remaining ſave only his Theory of the Heavens, which is called the *Pythagorick Syſtem*; he placing the Sun in the Centre, and the Earth moving round it; the Moon as an Antichthone or oppoſite Earth enlightned by the Sun, the Comets to be above the Air, or between that and the Planets; that the Heavens were fluid Æther, and the Stars ſo many Worlds. We know not his Sentiments about the *Coſmogonia*, or Terreſtrial Productions, for he more buſied himſelf about Cœleſtial Speculations, and about Abſtracts and Intellectuals, as did alſo his Followers, who treat of the *Anima Mundi*, conſiſting in Harmony indiviſible and diviſible the ſame, and an other (as they Phraſe it) and ſuch other Airy Notions as have no Foundations in Nature. But *Ocellus Lucanus*, another *Pythagorean*, makes the World Eternal, both for Matter and Form, as he does alſo the Race of Mankind. But indeed there is little in this Author that favours of *Pythagoras* his Doctrine; and *Plato* differs wholly from him, aſſerting the World to be made by God, and to be corruptible. Yet it muſt be granted that both the *Pythagoreans* and *Platoniſts* incline to make the Matter Eternal, but the Form Variable; and they had both their Vulgar Doctrines, and their Secret Doctrines. And though the Author cannot find any but common ſenſe in his Myſtical Numbers, yet he thinks there might be ſomewhat more, which is now loſt to Mankind: The chief of theſe was his *Tetractis*, the Seventh was not Ignoble, but the Tenth the Nobleſt and moſt perfect of all. But of the Reaſon and Signification of theſe neither any of the Ancients nor Moderns give any Satisfactive Solutions or Explications. Yet all the Ancients aſſert this to be the Doctrine of *Pythagoras*. And therefore after having run over many of their thoughts, the Author thinks that Numbers will produce nothing but Numbers, not Things; and that converting things all to Arithmetical Operations was in the *Pythagoreans* and *Platoniſts* a failure, not unlike that of the *Peripateticks*, of turning all into Logical terms. *Pherecides Pythagoras* his Maſter, writ a *Theogonia*. And *Empedocles*, one of his Scholars, aſſerted the Sun to be a Maſs of Fire, and the Stars to be fiery, and the Earth made of the four Elements, united by Love, and ſeparated by Strife. 'Tis uncertain whether *Pythagoras* wrote or no, but certain that *Philolaus*, *Archytas*, aud *Eudoxus* did. And 'tis ſaid *Plato* bought three Books of *Philolaus*, whence he took his *Timæus*. *Archytas* is ſaid to have written many things, but all are loſt but a Fragment about Mathematicks. *Eudoxus* alſo, and *Empedocles*, but all are now loſt. The Writings alſo of *Ariſtotle* concerning the four *Pythagorick* Elements are loſt, and ſome others. So are the Writings of *Ariſtoxenus*. *Heraclides*, *Neanthes Hermippus*, *Syrianus Didymus*, and *Eudoxus*. Alſo *Moderatus Gaditanus*, *Alexander* Polyhiſtor, *Androcidus*, and others.

In the Twelfth Chapter he enquires concerning the Opinions of the *Eleatick* Sect, and of the *Stoicks*. This Sect was Founded by *Zenophanes* in the times of *Anaximander*, and conſiſted of a Mixture of various Nations and Opinions. The Doctrine he held was, that there were infinite Suns, and infinite Moons like ours, which he ſaid was habitable, but that they were all Eternal. *Parmenides* held them to be formed out of Fire and Earth, and Men out of Clay. They agreed much with the *Ionick* Sect. *Leucippus* and *Democritus* were of this Sect, who introduced Atoms. *Leucippus* acknowledged the Motion of the Earth on its Axis, and that when the fluid Maſs ſetled into a Globe, it was covered by a dry Skin, which growing thicker, formed the habitable Earth: He ſuppoſes the Axis alſo at firſt right, but altered afterward; both which are conſonant to the Author's Theory. *Democritus* was an Auditor of *Leucippus*, and had travelled *Perſia*, *Arabia*, *Ethiopia*, *Egypt*, and *India*, to improve his Knowledge among the Learned of thoſe Couutries, and has written many Books, though all loſt. 'Tis ſaid he affirmed the Moon to be a fired Body, but with Mountains, Hills, and Vales; but the Author ſuppoſes only fiery Mountains, ſuch as are on the Earth. *Callimachus* wrote of his Opinions. The Opinion of the *Stoicks* is Famous for the Future Conflagration of the World. But little is to be found concerning the Production of it, yet they aſſerted God to be the Author of it; but to this they joyn Matter mixt and of it ſelf without Motion. This was periſhable by the Conflagration, but the Divine Principle Eternal, as they eſteemed alſo the Matter it ſelf, though the Form periſhed. So the unformed World they made Eternal, but the formed to have both beginning and end. They held moreover, of formed Bodies, the Fire to be firſt, and out of that to be made the other Elements, which again were reſolvable into it. Concerning the Mundane Periods and the Fate of the *Stoicks*, little need be ſaid in this Diſcourſe, it being well known. Many Books have been written by and concerning them, but all loſt; yet 'tis ſaid there is one Ancient Book or Piece of *Apollonius Tyrius* yet exſtant in ſome Library, but not publiſhed, concerning the Opinion and Works of *Zeno*.

In the Thirteenth Chapter he enquires among the *Platonicks*, *Ariſtotelians*, and *Epicureans*. Firſt, he finds the *Platonicks* like the *Pythagoreans*, to be moſt taken up in high Speculations of Abſtract Notions, and in aſſigning Cauſes of Things to Numbers and Geometrical Figures. Thus *Plato* in his *Timæus* makes nothing viſible but Fire, nothing tangible but Earth, between theſe two for their own Union are placed Air and Water. The Solid Bodies he ſuppoſeth made up of Triangles; Fire he makes of Pyramids, conſiſting of four Triangles; the Earth of Cubes, conſiſting of ſix Squares, and each Square of four Triangles; the Air of Octotedrons, each ſide divided into ſix Scalenes; then the Water of Icoſaedrons, conſiſting of Twenty Triangles, each made up of Scalenes. To theſe he adds a Soul, conſiſting of Numbers and Proportions. The beſt Interpretations yet extant concerning it do not make Senſe or Reaſon of it, and at beſt the Author thinks it but a *Luſus Ingenii.* Further, he makes God and Matter to be the two firſt Principles,to which he adds a third of Idea's. But *Plato*'s Excellency was not for Phyſicks, but for Morals and Theology. Divers Writings of the *Platoniſts* are out, and ſome loſt; but theſe he paſſes by, ſince we have the Works of *Plato* himſelf. And now comes to the Dregs of Philoſophy amongſt the Epicureans and Peripateticks. From *Plato*'s time to the preſent Age he finds nothing of Philoſophy, nothing of Diſcovery, nothing but a Chattering and fruitleſs Methods of Wrangling. Concerning the Origination of things, there is nothing found to be met with in *Ariſtotle* or his Schools. They would make the World Eternal, both for Matter and Form; Men alſo, and all things elſe to be ſo too. Beſides, he does not agree with his own Principles, deſpoſing the four Elements one above the other, but ſhews not how the Earth ſeems to be in ſome parts higher than the Water. Then for the Heavens he makes Adamantine Orbs, and the Stars like Golden-headed Nails faſtned to them: Theſe Orbs involved he makes to move round the Earth in 24 hours, that is every day. To this he introduces a contrary Motion for each Planetary Orb from Weſt to Eaſt; the Matter of theſe he makes incorruptible, but below the Orb of the Moon he puts Fire Elementary, without Light or Heat. In the middle Region of the Air he puts the Milky Way and Comets. For the explicating of all other things on the Earth, he introduces Subſtantial Forms, and Specifick Qualities, as inſignificant as the *Pythagorick* Numbers and Harmonies. Which being ſo, he wonders why it has been ſo long approved of by the Chriſtian World. Then the Author giving a ſhort Catalogue of his Errors, and bids adieu to him,as to a bad Aſtronomer,a worſe Theologe, and the worſt of all Phyſiologers. His Catalogue is this: 1. That the World is Eternal and Incorruptible. 2. The Heavens ſolid, and moved by contrary Motions. 3. The Matter of the Heavens Divine and Immutable. 4. The Stars to be denſer parts of their Orbs, and the Planets to ſhine by their own Light. 5. Light neither a Body nor a Motion. 6. Elementary Fire under the Moon. 7. The Galaxi and Comets, Meteors. 8. The Earth immovable, in the Centre of the World. 9. Up and down to be founded in Nature immutably. 10. The Forms of Animate things ſubſtantial. 11. Senſation to be made by Intentional Species. 12. Rarefaction and Contraction to be made by the increaſe and decreaſe of Extenſion in Matter. 13. Providence not to deſcend below the Moon. 14. The Soul to be ἐντελέχεια, and of doubtful Immortality. Next he viſits *Epicurus*, illiterate, yet of no Vulgar Wit; he accommodated all things to his Senſes, and ſo his Notions were for the moſt part abſurd and vulgar. He corrupted only the Doctrines of *Democritus* and *Leucippus.* Upon the whole, the Author thinks his Doctrines not worth conſidering, but refers the Reader to *Gaſſendus.* He concludes this Enquiry with giving the Names of ſeveral that have written of the Opinions of theſe *Grecian* Philoſophers, and of ſome that have written their ἀπόῤῥητα, or Secret Doctrines, as *Pythagoras Zacintheus*, *Porphyrius*, *Numerius*: He regrets the loſs alſo of many Polyhiſtorians, as, *Theopompus*, *Phavorinus* and *Alexander Polyhiſtor*; alſo ſome of the Writings of *Diodorus Siculus* and *Varro*. Now whereas ſome alledge ſome few others that have been famous for Philoſophy in other parts of the World, yet not what they knew or maintained; and there being no Monuments remaining of ſuch their Knowledge, the Author leaves them in the Obſcurity he found them, and thinks he has performed his deſigned Undertaking to ſeek what there could be found worthy of preſerving among the Ruines and Relicts of the moſt ancient Philoſophers, more particularly relating to the Beginning of things, and has left no quarter unſearched, nor omitted any thing which he judged material to this purpoſe; though other Particulars not pertinent, whether bad or good, he has omitted, as being impertinent.

To end this Diſquiſition, in the Fourteenth Chapter he enquires concerning the Beginning of the Barbarick Philoſophy; that is, whence the *Egyptians*, *Ethiopians*, *Chaldeans*, *Phœnicians*, *Arabians*, *Indians*, and other Orientals obtained their firſt Knowledge. There are two Opinions concerning it: One, that they were invented by themſelves; and the other, that they were taught by *Moſes* or *Abraham*. The Author approves neither of theſe. Not the firſt, becauſe he meets with no Mention of Experiments, or Obſervations, or Reaſoning and Demonſtrations, or Method, or particular Explications; but what was known was Traditional and Poſitive. Not the Latter, becauſe this Learning was eminent long before thoſe times; for that *Moſes* was bred up in the Schools of *Egypt*, and for that the *Ethiopians* were much preceeding to the *Egyptians*. Beſides the Inſtance of *Job*, who is thought by the Author to have much preceded *Moſes*; for that he takes no notice of the Jewiſh Laws, Ceremonies or Sabbath, yet was he one that worſhip'd the true God; and for that the Age of his Life was above 200 years, and he offered his own Sacrifices without a Prieſt. Upon the whole therefore the Author thinks it was conveyed to Mankind by the Sons of *Noah*, and by him from the Patriarchs of the Antidiluvian World. Theſe are the principal Matters treated of in the Firſt Book.

IN the *Second Book* the Learned Author deſigns to make uſe of ſuch Teſtimonies as he can find amongſt the Fragments of the moſt ancient Philoſophy, to confirm the Doctrines of his Theory of the Earth, delivered in the Firſt Book thereof, for that he has not therein alledged ſuch Teſtimonies to confirm it, intermingled with the Diſcourſe it ſelf, as he has done in the Second, but framed the whole from the Idea he had of the Nature of the things themſelves. And whereas in the former Book of this preſent Treatiſe he has inquired after the Ancient Doctrines concerning the whole, or the Univerſe: In this he reſtrains his Search after ſuch Doctrines as more particularly concern the Formation and Fabrick of the Earth only. In the firſt Chapter then he finds that the Production of this World out of a Chaos was the moſt general, and the moſt ancient Doctrine of all the Learned, both Theologers, Phyſiologers and Poets. He begins with *Moſes*, and ſhews, that his *Tohu* and *Bohu* was the ſame that the Ancients called Chaos. And the Apoſtle, *Heb.* 11. 3. does ſo interpret it, and moſt of the Chriſtian Interpreters underſtand it ſo alſo, as do the *Hebrews*. As to other Nations, they either deliver it expreſly, as the Philoſophers; or Mythologically, as the Poets. The Philoſophers differ only, for that ſome aſcribe the Formation to a Mind, others to Chance. He brings ſeveral Proofs of it from *Phœnicians*, *Egyptians*, *Greeks Romans*, *Perſians*, and from divers other Authors very famous among the Ancients; but others, as *Orpheus*, *Empedocles* and *Heſiod* made Strife and Love to Operate in the Separation and Union of the parts of the Chaos.

In the Second Chapter he enquires what Form they aſſigned to the Primogeneal Earth, and what Eſtates it was to undergo. *Firſt*, For the Form, that it was differing from the preſent. Here firſt he proves, by the Teſtimony of St. *Peter*, that there was a three-fold ſtate of the Earth, *viz.* the Paſt, Preſent and Future. By the Paſt he ſhews was meant the Antidiluvian, and by the Future the New Heaven and New Earth, which he proves by two paſſages in *Iſaiah*, and one in the *Revelation*. This he ſhews was alſo mentioned by St. *Paul* in the *8th* of the *Romans*, upon which Paſſage he inſiſts much to prove; that the Apoſtle meant this three fold ſtate of the Earth; and alledges the Judgment of the Fathers, *Tertullian*, *Irenæus*, *Origen*, *Hierom*, *Chryſoſtom*, and others to confirm it. And then endeavours to anſwer ſuch as had aſſigned other Expoſitions of the Word Creation, of which there are three ſorts. One would have the Fallen Angels to be underſtood, which he ſhews could not be the meaning, ſince they are not to be reſtored. Others would have by Creatures to be underſtood Men: But that cannot be the Senſe, becauſe the Creature and Men are diſtinguiſhed in the very Text. *Thirdly*, Thoſe that would have the *Gentiles* to be meant, are the fartheſt of all from the plain Sence which he makes to be (the formed World,) and that it is to paſs thorough three States, a former, a preſent, and a future.

In the Third Chapter he brings Authority to prove the Primigeneal Form and Situation of the Earth, and wherein it differ'd from the preſent, of which the Ancients had manifeſt Knowledge. The firſt he alledges is that of St. *Peter*, 2, 3, 6. where he ſays the Words are oppoſed to thoſe who aſſerted the ſtate of the World to be the ſame as at firſt: And adds, that St. *Auſtin* in expounding theſe Words of St. *Peter*, doth ſo underſtand them; to wit, that not only the old Earth periſhed in the Floud, but the Heavens alſo. He next enquires wherein the difference is between the former and the preſent, and finds St. *Peter* there deſcribing the firſt, to aſſert it to be out of the Water, and to ſtand by the Waters; that is, (ſays he) to be placed above the Waters, and be ſuſtained by them. And by this he explains *Pſal.* 136. 6. *Prov.* 8. 27. but brings no further Proof of his Doctrine.

In the Fourth Chapter he enquires concerning the Nature, Manner and Cauſes of Deluges, but chiefly of the Univerſal. Here he repeats what he has ſaid concerning the quantity of the Water requiſite in his Theory, and quotes alſo what *Iſaiah* ſays in deſcribing a general Deluge, who makes a kind of Earthquake to precede it, for the Eruption of the Waters out of their Womb, and ſeveral other places and Commentators upon them, who all ſeem to mean Earthquakes. Then he enquires what are the Cauſes of particular Inundations, which he makes Three. (*i. e*) 1. The Irruption of the Sea upon the Low Countries. 2. Great Rains. 3. Eruptions of Waters out of the Body of the Earth by Earthquakes: Of each of theſe he brings Examples out of Hiſtory. The firſt is *Strabo*'s Deſcription of the manner of making the Dead Sea where *Sodom* and *Gomorrah* formerly ſtood by an Earthquake. Secondly, A paſſage in *Amianus Marcellinus* about the ſinking and drowning of places. Another out of *Diodorus Siculus* concerning the City of *Atalantes*, and of *Strabo* for *Eubœa*. Another out of *Ziphiline* in the Life of *Antonius Pius*, of the loſs of the City of *Cyzicum*. Another out of *Diodorus Siculus* about the loſs of *Bura* and *Helice*. Another out of *Pauſonius* of the Loſs of the City *Idea*. Then he mentions the *Ogygian* and *Deucaleon* Floods. Of *Deucalians* he remarks a notable paſſage out of *Lucian*.

In the Fifth Chapter he enquires whether there be any Record among the Ancients that may confirm his Conjecture about the right Situation of the Earth to the Sun. Whence proceeded a perpetual Equinox without differing Seaſons: For this he looks for the Deſcription of the Golden Ages, *viz.* in *Plato*'s *Phœdo*, where he ſays, under *Saturn* the Motions of the Heavens were uniform, but under *Jupiter* there was an ἀναρμοστία of the Heavens to the poſture they are now in, which was the Cauſe of all the Evil that followed. He ſpeaks alſo of its Renovation, or being reſtored to its former ſtate. Of theſe things we have an imperfect Account, by reaſon of the length of Time paſt; but theſe and greater, or more wonderful things have happened. Next for the Earth, *Plato* ſays it was equilibrate without Inclination, ἰσοῤῥόπον ϗ ἀκλινὲς. Further, he makes the Seaſons all temperate, which gave Men long Lives. He makes alſo an Abyſs to receive the Water trajected through the Earth; but the Surface of it he makes ſmooth, and adorned with various Colours and Gems, as the Prophets and Sacred Authors do the *New Hieruſalem.*

In the Sixth Chapter he enquires concerning the changed Poſition of the preſent Earth: For this he has a Cloud of Teſtimonies beſide *Plato*, to wit, *Anaxagoras*, *Empedocles*, *Diogenes*, *Leuceppus*, *Democritus*, who all ſpeak of the changed Situation of the Earth's Axis, whoſe Teſtimonies he has elſewhere mentioned. Among the Inventions of the Aſtronomers, the Obliquity of the Zodiack and the Seaſons of the Year are aſcribed to *Thales*; which is an Argument it had not been ſo from the beginning. But the Hiſtories of the Progreſs of Aſtronomy, written by *Eudemus* and *Theon Smyrneus* have periſhed, which might have afforded more cogent Arguments. Here he mentions what *Ovid*, *Virgil* and *Homer* have ſaid to this purpoſe, in deſcribing the Golden Age and the Elizium of the Dead. From the Poets he paſſes to *Plutarch*'s Deſcription of the Fortunate Iſles, which is a more modern Name for the *Elizium*, and agrees much with the Paradiſical Earth. And another out of *Diodorus Siculus*, of the Iſland *Tabrobana*; which he ſuppoſes to be for the ſame purpoſe. From theſe Heathens he comes to the Jewiſh and Chriſtian Writers, deſcribing Paradiſe and the Garden of the Lord; who do much agree with the Heathen Deſcriptions of the Golden Age. He quotes *Iſ. Abarbanel* upon the 2d of *Geneſis*, and *Aben Ezra*; alſo *Maimonides* upon the 10th Chapter of the *Sanhedrim*; *Manaſſeh Ben Iſrael* on the Creation, and *Abraham Ecchellenſis* concerning the Teſtimonies of the *Jews* and *Arabians*. Then for the Chriſtians he brings *Tatianus*: He quotes alſo *Suidas*, and ſums up all with *Bellarmine*'s Concluſion, That there was a perpetual Spring, and another Courſe of the Sun then at preſent. He adds, that *Ariſtotle* thought the ſhort and uncertain Life of Creatures proceeded from the Oblique Motion of the Sun in the *Zodiack*: And that *Mantuan* ſays, it was the Opinion of the ancient Aſtronomers. He adds alſo a Paſſage of *Orpheus* preſerved by *Proclus* to the ſame effect.

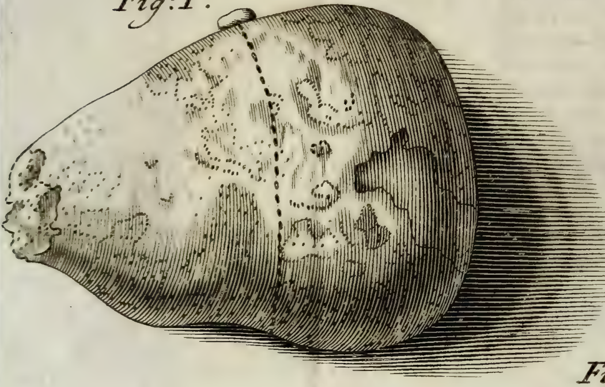
In the Seventh Chapter he diſcourſes of the Deſcription which *Moſes* gives of Paradiſe, and of the ſtate of Nature in the New World; which is in general, That *Moſes* accommodated his Hiſtory to the Capacity of thoſe for whom he writ, and that all he has ſaid is not to be taken in a ſtrict literal Senſe. Then in the Eighth Chapter he ſpeaks of the manner of the Interpretations of the Expreſſions of *Moſes* concerning the *Hexameron*, which is conſonant to his Thoughts in the Seventh. And in the Ninth Chapter he endeavours to anſwer thoſe who would have it to be literally underſtood. And in the Laſt Chapter he propounds what things are worthy to be conſidered in order to the making a right Judgment of the whole; and more particularly, of what he hath more freely delivered in the preceding Chapters. He deſires his Readers therefore to conſider the Uſe and Style of the Eaſtern Sages. 2. The mean and dull Apprehenſions of the *Iſraelites* at the time when *Moſes* writ. 3. What Learned Commentators have ſaid of this matter. 4. What we are to think of the Great God, and what Thoughts concerning him are worthy, and what beſeeming. As to the Firſt, Theſe Orientals did for the moſt part deliver their Doctrines in Mythology, *ad Captum Vulgi*: But they had alſo a more Secret Doctrine, which they deliver'd only to ſuch of their Schools as were of a more clear Underſtanding. So that though many vulgar Opinions have been aſcribed to them, yet they were ſuch as were deliver'd for the Vulgar, but that they had others reſerved for the more intelligent. So *Iamblicus* and *Laertius* relate ſome Notions of *Pythagoras*, which accorded with the

Vulgar Opinion of the Heavens; yet 'tis plain he held the other Doctrine. The Jewiſh Doctors ſay, the Law ſpeaks with the Tongues of Men; that is, with a Vulgar Style, yet they had their *Cabala* to conceal their Myſteries: Nor was this Foreign to the Chriſtian Schools. Secondly, The People of *Iſrael* when *Moſes* writ were of dull and uncultivated Underſtanding, not fit for Natural Speculations or Divine Contemplations. Thus much *Manaſſeh Ben Iſrael* ſays, and ſo does *Moſes Maimonides*. This he conceives to be the reaſon why *Moſes* ſo wrote the Hiſtory of the Creation. Thirdly, Commentators both Jews and Chriſtians have aſſerted, That many things in that Hiſtory are not to be underſtood Literally but Allegorically: For this, beſides *Philo Judeus*, who makes it all Allegorical; and the *Cabaliſts*, whom he paſſes by, he names *R.* Moſes *Egyptius* for a ſolid Author aſſerting it, and *Joſephus*; as alſo *Ariſtobulus*, quoted by *Euſebius*, who is of the ſame Sentiment, as were many of the Chriſtian Fathers which he cites at large. Fourthly, As to ſuch as do not adhere to the Literal Senſe, he admoniſhes them that they do not admit any thing unworthy of God or of our Religion.

Printed for *S. Smith* and *B. Walford*, Printers to the
Royal Society, at the *Princes Arms* in St. *Paul's*
Church-yard, 1693.

BRITISH MUSEUM NATURAL HISTORY

Fig:1.



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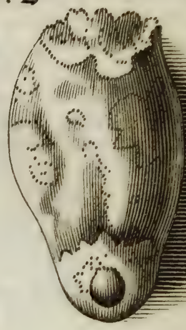

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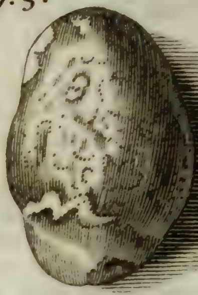

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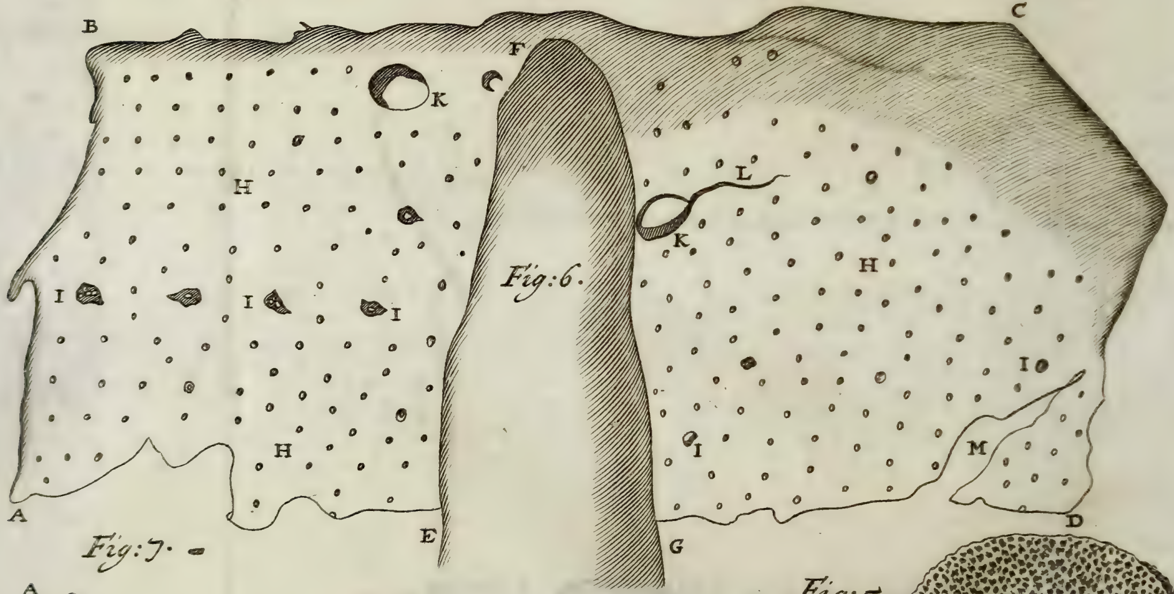

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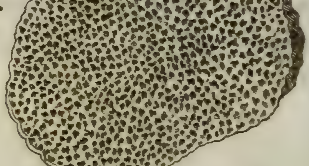

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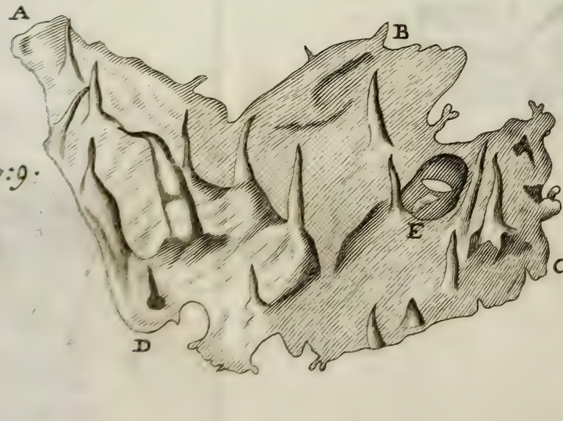

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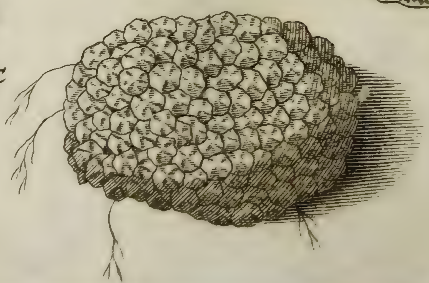

Fig:8.

Numb. 202.

PHILOSOPHICAL TRANSACTIONS.

For the Months of July *and* Auguſt, 1693.

The CONTENTS.

I. *A Query put by Dr.* N. Grew, *S. R. S. Concerning the Food of the* Humming Bird; *occaſioned by the Deſcription of it in the Tranſactions,* Numb. 200. II. *Some Obſervations made by Mr.* Paſchall, *on the Motions of Diſeaſes, and on the Births and Deaths of Men and other Animals, in different times of the* Νυχθήμερον. III. *Dr.* Mullineux's *Account of a Stone of extraordinary bigneſs, ſpontaneouſly voided through the* Urethra, *by a Woman at* Dublin. IV. *An Account of the* Tubera Terræ, *or Truffles found at* Ruſhton *in* Northampton-ſhire, *with ſome Remarks thereon by* Tancred Robinſon, *M. D. and S. R. S.* V. *A Letter from Mr.* Martin Hartop *at* Naples *to the Publiſher, concerning the late Earthquake in* Sicily. VI. *An Extract of an Account of the Earthquake mentioned in the foregoing Letter, taken out of an* Italian *Paper. Written by* P. Aleſſandro Burgos. *Printed firſt at* Palermo, *and afterwards at* Naples, 1693. VII. *An Extract of a Letter from Mr.* Anth. Van Leeuwenhoek, *S R.S. containing ſeveral Obſervations on the* Texture *of the* Bones *of Animals, compared with that of Wood, on the* Bark *of*

Trees. *On the* Scales *found on the Skin*, &c. VIII. *A Propoſal concerning the* Parallax *of the fixt Stars in reference to the Earth's* annual Orb*: Being the Extracts of ſeveral Letters, dated* May 2. June 29. *and* July 20. 1693. *from the Reverend Dr.* John Wallis, *S. R. S. to* William Molineux, *Eſq*; IX. *An Account of a Book, Entituled,* Synopſis Methodica, Animalium Quadrupedum & Serpentini Generis, Vulgarium Notas Characteriſticas, Rariorum Deſcriptiones integras exhibens: Cum Hiſtoriis & Obſervationibus Anatomicis perquam curioſis, *&c.* Anctore *Joaune Raio*, S. R. S. in 8°. Lond. Impenſis *S. Smith* & *B. Walford.*

An ADVERTISEMENT belonging to Page 826. of this Tranſaction.

FIG. 4. repreſents one of the *Tubera Terræ* whole, the *Papillæ* and *Fibres* being obſervable thereon. *Fig.* 5. The ſame Truffle cut through the middle to ſhew the inſide full of whitiſh Veins.

ERRATA.

NUmb. 198. p. 661. l. 14. for *Cartilages* r. *Tendons.* p. 670. r. *Gnaphalium*, p. 681. l. 1. r. $Q = \frac{2}{3}$. Numb. 199. p. 713. l. 23. r. *ſetting on of.* p. 714. l. 26. r. *Fig.* 14. p. 715. l. 17. r. *determine*, p. 716. l. 6. r. *Aqueus.*

I. *A Query put by Dr.* N. Grew, *concerning the Food of the* Humming Bird; *occaſioned by the Deſcription of it in the Tranſactions.* Numb. 200.

S I R,

SInce I ſhewed you the Deſcription of the *Humming Bird*, with the Letter in which it came to me: I learn, that Mr. *Hamerſly* of *Coventry* is the Author of it. You ſee it is believed he feeds on ſome Juice he ſucks off, or out of Flowers. It was believed for a long while, that the Bird of Paradice had no Legs. Whether may not this Bird rather feed on ſmall Inſects, whereon many Birds feed, ſome whereof lie in the bottom of moſt Flowers, and for which, this Bird hath a Bill? Whereas a Bee that ſucks hath a Siphon or hollow Probe. In ſhort, the Bird ſhould be open'd: And ſo it will appear, either that he hath Entrails fitted only for Liquids; or the ſame ſort of Stomachs and Guts as other Birds, containing the ſame ſort of ſolid Food.

II. *Some Obſervations made by Mr.* Paſchall, *on the Motions of* Diſeaſes, *and on the* Births *and* Deaths *of* Men, *and other* Animals *in different times of the* Νυχθήμερον.

SOme Months ſince I fell into a Suſpicion, that the Cauſes of *Tides* at Sea do alſo continually exert their Power in other places, though the Effects thereof may not be ſo ſenſibly perceived on the ſolid as the fluid parts of this *Terraqueous* Globe. That I might in the beſt way I could think of, make ſome tryal towards a diſcovery of the Truth herein, I took this Method. Firſt, I divided the Νυχθήμερον into four Senaries of Hours: The firſt conſiſted of three Hours before the *Southing* of the *Moon*, and three after the ſecond of the ſix hours following, and ſo the third and fourth contained the two remaining Quarters of the Natural day. I next betook my ſelf to obſerve Births and Deaths, in our own kind, as alſo in other Species of *Animals*, whether they fell out indifferently in any of theſe four Senaries: And I found none that were born or died a natural Death in the firſt and third Senaries, which I take liberty to call firſt and ſecond Tides, but every one either in the ſecond or fourth Senaries, which I call firſt and ſecond Ebbs. I then proceeded to make Obſervations in the Motions of Diſeaſes, which I could the better do, becauſe I had ſome in my Family viſited with Agues. Here I found that the tumult of the Fits generally laſted all the Tiding time, and then went off in gentle kindly Sweats in the Ebbs. I went on then to take notice of the *Sex res non naturales*, and alterations of the Weather, and ſuch Accounts as I could meet with of *Earthquakes* and ſundry other things: And I have yet met nothing to hinder me from laying down this as a Maxim, That Motion, Vigour, Action, Strength, &c. appear moſt and do beſt in the *Tiding Senaries*; and that Reſt, Relaxation, Decay, Diſſolution belong to the *Ebbing Senaries*.

III. *Dr.* Mullineux *his Account of a Stone of an extraordinary bigneſs, ſpontaneouſly voided through the* Urethra *by a Woman in* Dublin.

WOmen are made by Nature of a more nice Compoſition, and weaklier Frame than Men, and are therefore liable to many Infirmities that Men are not the leaſt ſubject to. Yet in one of the moſt painful that afflicts the Body, the Stone in the Bladder, they have much the advantage, and are more rarely troubled with it than Men.

For among the two vaſt Collections of Stones, that amount at leaſt to ſeveral Thouſands, kept together in the Hoſpitals at *Paris l' Hotel Dieu* and *la Charité*, cut out only of ſuch as come thither to be cured, not one in an Hundred, I might ſafely ſay more, is taken out of a Woman.

This remarkable difference muſt certainly proceed from the Urinary Paſſage in this Sex, being ſhorter, larger, and more apt to dilate; ſo that for the moſt part, when Gravel, or a ſort of viſcous claiy matter, which I take to be the chief Cauſe of the Generation of the Stone, falls into the Bladder, 'tis ſuddenly and eaſily diſcharged, e're it can cohere together and form a Stone of any large Bulk, which cannot ſo frequently happen in Men, by reaſon of the narrowneſs, crookedneſs, and length of the Paſſage of the *Vrethra*.

However it ſometimes comes to paſs, that even in Women, either from a more depending, or leſs elevated Poſture than uſual in their Bladder, or that the matter forming the Stone adheres to ſome part of its Membranes, ſo that it cannot fall in the Urinary Paſſage, till its own Bigneſs or Gravity forceth it thither, Stones of a very conſiderable Bulk are generated.

Of this we have lately had here in *Dublin* a very remarkable Example: One *Margaret Plunket* alias *Weldon*, to give her her Maiden Name according to the *Iriſh* way, the Mother of Five or Six Children, Cozengerman by her Mothers ſide, who was the Lord *Netherfield*'s Siſter, to my Lord *Tirconnell*, born in the County of *Meath*, about Sixty Years of Age, now living in *Church-ſtreet*, *Dublin*, on *May* 29. 1691. voided through her Urinary Paſſage, by the help of Nature alone, without the uſe of Remedies, or any forcible means whatever, V. *Fig.* 1. a Stone of this Shape and Size, ſomewhat reſembling a hard Pear a little preſs'd or flatted.

Its Circumference meaſured the longeſt way is 7 Inches and $\frac{3}{10}$, round about where it was largeſt 5 Inches $\frac{3}{4}$; its Weight at preſent, according to *Troy* Pound, ℥*ij*, ʒ*ij*, ℈*j*, *gr.* 6. for it has loſt conſiderably both of its firſt Bulk and Weight by many little Fragments breaking off from the ſmaller end *A*, where 'tis much ſofter, ſmoother, whiter, its parts more porous, and ſo incoherent, that the leaſt force ſevers them: Whereas the bigger end *B*, as far as the Stroke *ccc* paſſes, is of a very different Texture, much more cloſe and compact, covered with a yellowiſh ſhining Cruſt, ruff, granulated, and as hard as the beſt *Portland* Stone.

This different Texture of Parts in one and the ſame Stone, obſervable in moſt of this kind if they be of a large Size, proceeds, I am apt to think, from the ſame conſtant Bed or ſettled poſture of the Stone in the Bladder, whereby ſome parts of it are more expoſed to imbibe the Moiſture of the Urine as it falls or ſettles in the Bladder than others; and by this ſort of Maceration are kept ſoft, whilſt thoſe parts that lie higher towards the upper Region of the Bladder remain dry, harder, and gather a ſort of gritty Cruſt, as we find moſt ſoft Stones do, that are dug out of the moiſt Earth, when expoſed a while to the dry Air.

It ſeems to me very probable, that Stones when they come to be of a large ſize, keep much one and the ſame poſture in the Bladder at all times, there not being room in ſo pliant and membranous a Body, that always contracts it ſelf to the leaſt Dimenſions it can, to allow a Stone of any conſiderable Bulk ; for the Caſe is different in thoſe that are ſmall, to tumble or change its Situation very much.

But however this Conjecture may prove true or falſe, 'tis undeniable, that ſome Stones from their way of Generation muſt of neceſſity remain fixt and immovable in the Bladder ; being cloſely joined and united to the very ſubſtance of its Membrane, of which ſort there are ſeveral Examples recorded by *Scenkius*, and other Collectors of Obſervations : And I'm perſwaded this Stone I am now deſcribing may be reckon'd among them : For about the larger end, where 'tis marked *d d d*, there ſtill cloſely adheres ſeveral thin Films and carneous Filaments, which manifeſtly ſhew it was formerly united by this part to the membranous Subſtance of the Bladder, and that lately by its own Weight, or ſome other Accident, it was torn away, and fell into the *Urethra*, through which 'twas voided ; and hence it was that this Woman, as ſhe her ſelf told me, never ſuſpected her ſelf, till very lately, at all troubled with the Stone.

For theſe Three Months paſt, whilſt 'twas ſticking in the Urinary Paſſage and coming away, ſhe has ſuffered great Pains, and a perpetual Strangury, or an involuntary dropping of her Water from her ; and this Infirmity ſtill continues, by reaſon the largeneſs of the Stone has over-ſtretch'd the Fibres that compoſe the Sphincter of the Bladder in its Paſſage through it, whence their Tone is ſo relaxt, they have loſt all power of Retention : And for this Reaſon, I find all Women that void Stones this

way,

way, of any conſiderable bigneſs, are conſtantly attended with this Weakneſs.

But this Trouble is fully recompens'd by the Remiſſion of her Pains, which, ſince the Stone came away, are ſo abated, that ſhe can walk about, and is now able to come abroad.

'Tis very extraordinary that ſo large a Stone ſhould be naturally voided by the Bladder; and I have read but of very few that come nigh the bigneſs of this, which I have now in my Poſſeſſion, and keep among ſome other natural Productions, as a curious Rarity.

Thomas Bartholine in his *Centuria* I*a* *Hiſt. Anat. Obſervat.* 71. ſets down the Deſcription and Figure of a very large Stone as he thought, though he ſays 'twas but *Ovi Gallinacei magnitudine*, that came from a Woman as this did.

And *Daniel Angelus* in the *Miſcellan. Phyſico-Medic. Germanic. An.* 1676. *Obſervat.* 195. gives the Figure of another Stone, much of the ſame ſize with *Bartholine's*, ſpontaneouſly diſcharged the ſame way.

Likewiſe *Petrus Borellus Centuriæ Secundæ Obſerv.* 22. mentions a Stone, but gives no Figure of it, voided by a Girl through her Urinary Paſſage, *Ovi Anſerini magnitudinis*, as his own Words are, which I ſuppoſe was much of the ſame ſize with this of ours.

But *Nicolaus Tulpius* in his more elaborate Obſerv. *Lib.* 3. *cap.* 7. gives an Account of a Woman 89 Years of Age, that voided a Stone, of which he gives you an accurate Figure, full as broad, ſomewhat longer, and almoſt ℥*j* heavier than this I have deſcrib'd; yet ſhe lived after it, and was ſo well as to walk abroad.

I mention theſe ſeveral Examples, not only to illuſtrate and confirm the Truth of our preſent Story, even to the moſt incredulous; but as ſo many Arguments, from whence I think, one may reaſonably infer, That no Woman need be obliged ever to undergo the painful and hazardous Section of the Stone; though ſome among the Ancients deſcribe the particular manner how the Operation is to be perform'd in this Sex; as *Ælius Tetr.*4. *Sermon* 4. *cap.*99. And among the Moderns, Monſieur *Tolet Traitè de la Lithotomie*, *Chapit.* 15. *pag.* 122.

For ſince Nature by her own Power, without the Aſſiſtance of any Help or Remedies, could disburthen her ſelf, and force away ſuch large Stones as theſe here deſcrib'd, why may we not probably conclude, That even thoſe ſtill of a larger, if there be any ſuch bred in Women, as one may well queſtion, ſince all thoſe Accounts of Stones of prodigious Bulk bred in the Bladder, are related of Men only; as if Nature kept ſomewhat the ſame Rule of Proportion in theſe ſort of Productions, as ſhe obſerves generally in the Stature of Men and Women: I ſay, why may not they be brought away, by putting the Body into a convenient Poſture, and ſo by the Hand and Fingers forcing the Stone into the Urinary Paſſage, which by Application of relaxing and ſtrongly emollient Remedies, may be ſo dilated, as to give a free Paſſage to the Stone without any forceable Section?

But this I leave to be determin'd by ſuch, who lighting upon proper Subjects, may have occaſion hereafter to try the Succeſs of this Practice, which if found to anſwer Expectation, may be of ſolid and real uſe.

July 14. *An.* 1691.

Since my writing the foregoing Account, Mr. *Thom. Proby*, an ingenious Chyrurgion of this Town, has lately in two Inſtances of Fact, ſucceſsfully demonſtrated the Practicableneſs of what I then propoſed only with Probability, touching the Extraction of Stones bred in the Bladders of the Female Sex without any Inciſion, as well thoſe of a large, as thoſe of a ſmaller Magnitude.

The firſt Inſtance is the more remarkable, as well for the Girls being very young, and by conſequence the Paſſage of her *Vrethra* ſtrait and ſmall, as that the Stone was extraordinary long, and conſiderably large for one of her Years. The annext Figure expreſſes exactly V. *Fig.*2. enough both its Shape and Bigneſs. The Child's Name was *Sarah Cooke*, about Six Years old; for ſome Years paſt ſhe had been ſo miſerably afflicted with the Stone, and a perpetual Incontinency of her Urine, that her Parents at any Hazard were willing to attempt relieving her of ſo violent a Pain, and ſo foul a Diſtemper. Whereupon, *June* the 8th, 1693. the Child being placed in a convenient Poſture in a Man's Lap ſitting acroſs a Table, with her Arms tied down to her Legs by a ſort of Bandage uſual in theſe Caſes, the Chyrurgion firſt paſt his *Catheter* into the Neck of the Bladder, that it might empty it ſelf of all Urine, before he inſerted his Dilatory Inſtrument, or his *Speculum Veſicæ* as one may call it, with which he extended the *Vrethra* as much as poſſibly he might with ſafety, and without putting the Child to extraordinary Pain; afterwards by help of a Directory and Forceps gently thruſt into the Bladder, he brought away the Stone without any manner of Inciſion in about 3 or 4 Minutes time from the paſſing in of his firſt Inſtrument, and put the Patient to ſo little Pain during the Operation, that when it was over, and ſhe laid quietly a-bed, ſhe ſlept without any Opiate 7 or 8 Hours together, as ſhe had not done in many Months before, and is now perfectly well and at eaſe. Whether hereafter the Sphincter of the Bladder may reſtore it ſelf, and become ſo ſtrong, that ſhe ſhall not be liable to a *Stillicidium Vrinæ* as heretofore, the only Inconvenience that may be feared at any time can attend this ſort of Operation, is uncertain as yet, ſince 'tis ſo lately perform'd; but being ſo young a Child, and the conſtant Cauſe of the Relaxation of the Sphincter, the Stone in the Bladder being

ing now wholly removed, 'tis probable ſhe may recover it, and not be ſubject to this Weakneſs as heretofore.

The other Inſtance is a Child ſomething elder, about 10 Years of Age, her Name *Elizabeth Mortimer*, who has been troubled with an Involuntary diſtilling of her Urine, and other painful Symptoms of the Stone for theſe three or four years paſt; but on *June* the 12th, 1693. was happily relieved by the extraction of a large Stone near as big as a Pigeons Egg, after the ſame manner and method as before deſcrib'd, and with as good Succeſs, though not altogether with as quick Expedition.

From theſe Examples one may reaſonably conclude, That thoſe of intermediate Years as well as Childhood and Old Age, are capable of undergoing this Operation of Extraction of the Stone with Safety: And I make no great doubt to aſſert, That 'tis the only proper and ſecure way of freeing the Female Sex from the Stone in the Bladder, and that ſuch ſhould never be perſwaded to undergo the Section upon any account, ſince the Stone, if it be not of an immoderate bigneſs, may be extracted by dilating only the Neck of the Bladder; and if it be of ſo large a Bulk, (as I have reaſon to think it never, or very rarely is in this Sex) as that it cannot be drawn out this way; then the Section, if the Chyrurgeon be ſo bold as to venture on it, muſt be made ſo wide, as wholly to cut through the ſhort Neck of the Bladder, and to divide likewiſe ſome part of its thin membranous Subſtance, which is known to be of the moſt dangerous conſequence in cutting the Stone, and to be avoided as certain Death to the Patient.

I have added the Figures of the Three *S*tones I have here mention'd, all expreſs'd as big as the Life. That Mark *Fig.* 1. is the *S*tone ſpontaneouſly voided by the Old Woman. *Fig.* 2. was taken out of the Child *S*ix

Years Old. And *Fig.* 3. was brought away from the Child Ten Years Old; both theſe without any *Section.*

IV. *An Account of the* Tubera Terræ, *or Truffles found at* Ruſhton *in* Northamptonſhire; *with ſome Remarks thereon. By* Tancred Robinſon, *M. D.* and *R.S.S.*

S I R,

THE *Tubera Terræ* (which you was pleas'd to ſend me, together with a Draught of them drawn with your own Pencil) obſerv'd lately at *Ruſhton* in *Northamptonſhire*, by that curious and learned Gentleman Mr. *Hatton*, are indeed the true French *Truffles*, the Italian *Tartuffi* or *Tartuffole*, and the Spaniſh *Turmas de Tiera*, which are not noted by Mr *Ray* to be found in our Britiſh Soyl. I have ſeen them thrice as large at *Florence*, *Rome* and *Naples*, where they eat them as a delicious and luxurious piece of Dainty, either fry'd in ſlices with Butter or Oil, Salt and Pepper; or elſe out of Pickle, and often boyl'd in their Soup. Of theſe there are three or four Species mentioned by *Matthiolus*, *Imperati*, *J. Bauhine* and *Mentzelius*.

Theſe obſerv'd in *England* are all included in a ſtudded Bark or Coat, the Tubercules reſembling the *Capſules* or V. *Fig.* 4. Seed-Veſſels of ſome *Mallows* and *Alcea's*; the inward ſubſtance is of the conſiſtence of the fleſhy part in a young Cheſnut, of a paſte Colour, of a rank or hircine Odour, and unſavoury, ſtreaked with many white Veins V. *Fig.* 5. or Threds, as in ſome Animals Teſticles; the whole is of a globoſe Figure, though unequal and chinky.

What theſe *Trubs* are, neither the Ancients nor Moderns have clearly informed us; ſome will have them *Calloſities*, or *Warts* bred in the Earth: Others call them ſubterraneous *Muſhrooms*. If you could ever find *Veſtigia* or Marks of a Stalk, or of Fibres, or Capillaments about their outſides, I ſhould be then almoſt tempted to gueſs, that they are the Product of ſome Bulboſe or Tuberoſe Plant, perhaps a *Satyrion* or *Orchis*, or ſome other Root of that numerous Tribe, many of which have a Seminal Smell.

I conjecture that theſe *Tubera Terræ* were found after the late Thunder and Rains; for ſome of the Ancients call'd them *Ceraunia*, to which *Juvenal* ſeems to allude, *Sat.* V.

Poſt hunc raduntur Tubera, ſi ver
Tunc erit, & facient optata tonitrua cœnas
Majores: tibi habe frumentum, Alledius inquit
O Libye: disjunge boves, dum tubera mittas.

They are moſt tender in the Spring; though after Showers and ſultry Weather they may be plentifully found in the Autumn: the Wet ſwells them, and Lightning may diſpoſe them to ſend forth their particular Scent ſo alluring to the Swine.

Ludovicus Romanus, *Navigat. Lib.*1. *cap.* 7. affirms, That Thirty Camels Load of theſe *Truffles* or *Trubs* brought from *Armenia* and *Aſia Minor* have been all ſold at *Damaſcus* in two or three days. The manner of finding and rooting them up may be read in Mr. *Ray*'s Itinerary of *Italy*, p. 403, 404. and in his *Catal. Stirpium Exot.* at the end of his Travels, *p.* 109.

I need not tell you the Uſes to which the *Greeks* and *Romans* apply'd theſe Vegetable Bodies, nor how they are dreſs'd and eaten at this day. *Pliny*, *Martial*, *Plutarch*, *Athenæus*, *Galen*, *Apicius*, &c. may be conſulted

for

for the firſt; *Nonnus*, *Bruyerinus*, *Ciccarellus*, &c. for the laſt.

POSTSCRIPT.

AFter the writing of the foregoing Letter, I received Intelligence, that Mr. *Hatton* obſerv'd Fibres iſſuing V. *Fig.* 4. out of ſome of theſe *Tubera*, which lay Spit deep under ground; ſo that perhaps they may be *Plantæ ſui generis*, and their ſulcated *Papillæ* analogous to, if not Seed-Veſſels. You know ſeveral Vegetables bear their Seed near the Root, as the *Trifolium ſubterraneum tricoccum reticulatum floſculis longis albis*; moſt of the *Arachydna's*, and ſome other *Legumes*, which flower above, but ſeed under ground. As to the *Truffles* lying ſo deep, that is common to many Roots that ſhoot up Stalks above the Earth. To inſtance only in that *Lathyrus tuberoſus*, call'd commonly *Chamæbalanus* and *Terræ Glandes*; in Engliſh, *Peaſe-Earthnut*, digg'd up and eaten by the poor People, *Non niſi altâ foſſione inveniendæ*, ſays *John Bauhine*. But for a clear Hiſtory of theſe, our Judicious Mr. *Ray* may be conſulted, *Hiſtor. Plant. Vol.* 1. p. 895, 899, 918, 919, 942.

The Roots of our *Bulbocaſtanum* (of the Umbelliferous Tribe) commonly call'd *Kepper-Nuts*, *Pignuts* and *Gernuts* in the North, lie very deep, and fatten Hogs, which are very greedy of them. I have often obſerv'd the Shepherds and Boys in *Yorkſhire* digging them up for a delicate Diſh: Perhaps this is the *Nucula Terreſtris Septentrionalium* of *Lobel*, and the *Apios* of *Turner*.

Fleetſtreet, Aug. 29.
1693.

Yours, &c.

Tancred Robinſon.

V. *A*

V. *A Letter from Mr.* Martin Hartop *at* Naples, *to the Publiſher. Together with an Account of the late Earthquake in* Sicily.

Worthy S I R,

I Have ſent you, as you deſir'd, all the Account which has yet ſeen the Light of the late Earthquake in *Sicily.* There was nothing that ever I could hear of particular in it, and therefore you can expect no great matter of Reflection upon it. However, to comply with your Commands, I ſend you my general Thoughts of this and ſuch like *Phænomena.*

Firſt, It ſeems highly probable that theſe Tremblings of the Earth proceed from the ſame incens'd matter, which finding a way at other times through the *Mongibello*, has ſo furiouſly broken out in Smoak and Fire: This appears by the Tragedy of *Catania.* Now you muſt know the Eruptions of theſe Mountains are of two ſorts; the one not ſo very violent as to diſturb much the adjacent Country, and this happens once in two or three Months, and laſts three or four days. The other is more furious and of longer Continuance, and is obſerv'd here at *Naples* to happen to Mount *Veſuvio* once in about Eighty Years, as I heard the ingenious Mr. *Peccacio* ſay. Of theſe, the laſt, which as well as I remember, he ſaid was in 1632. was ſo very violent, that by the beſt of his Obſervation it caſt the Rocks three Miles into the Air. Now from the burning or not burning of this Hill, *Naples* (and without doubt the ſame holds in *Sicily*) calculates its ſafety or danger of Earthquakes: For without doubt the matter is perpetually burning under the Mountain; and thoſe vaſt Clouds of Smoak which daily iſſue out of the top, if the Cavity happen by any Rock or

inward

inward Alteration to be ſtopt, muſt deviate through other Paſſages under ground, heaping up continually Magazines for a future Calamity. Now this combuſtible matter ſeems to me to be nothing but Nitre mixt with ſome other Minerals and Sulphur. He that has ſeen the way of making Salt of *Tartar* by Deflagration, where you mix an equal quantity of pulveriz'd Nitre, has ſeen an exact Type of theſe burning Hills: For after each ſpoonful you put into the burning Crucible, ariſes firſt a black thick Smoak, after which the fired Mineral boils up, as if it would over run the top of the Crucible.

This I take to be the matter. But, 2*ly*, How this Motion of the Earth is perform'd is not ſo eaſily explicable, eſpecially if one conſiders, that the Motion of the Earth is not from the Perpendicular, but Horizontal *Verte*; 'tis a Vibration ſo quick, that it cracks the Glaſs in the Windows: 'Tis diſputable whether the Reciprocations of a Lute-ſtring are more frequent. Now when the Vibrations are ſo quick, and the Body mov'd ſo great, the Motion muſt be prodigiouſly violent, and by conſequence the Cauſe, which I take to be nothing elſe but the aforeſaid Vapours incens'd. We obſerve the Thunder, which is the effect of the trembling of the Air, caus'd by the ſame Vapours diſpers'd through it, and encountring one the other, has force enough to ſhake our Houſes. And why their may'nt be Lightning and Thunder under ground in ſome vaſt Repoſitories there, I ſee no reaſon, eſpecially if we reflect, that the matter which compoſes the noiſy Vapour above us, is in much larger quantities to be found under ground. Now if you ask me how this Horizontal Trembling is perform'd, (for ſuch doubtleſs it is, as appears by the Cracks in the Earth, which they ſay, are to be found now all over *Sicily*) I can attribute it to nothing elſe but the furious Paſſage of the incens'd matter from one Grotto to another: For 'tis very probable theſe are continued in ſome parts of the Earth for ſeveral Leagues together : Witneſs your laſt Earthquake about four or five year ago, which was felt, (with little difference as to time) in *England* and *Ireland*. Another Confirmation of this, is, the manner theſe trembling Fits are perform'd; which is not all of a ſuddain, like that of Gunpowder in a Mine, but is ſmall at firſt, afterwards gradually more terrible, like a growing Tempeſt. A Third may be, the Obſervation of ſome here in *Naples*, that when Mount *Veſuve* ceaſes to burn, the *Sulfaterra* ſends out its Fumes more violently, & *vice verſa*. Now this *Sulfaterra* is a Hill near *Puzzolo*, as diſtant from *Naples* on the one hand as the Hill *Veſuvio* is on the other; ſo that 'tis more than probable *Naples* ſtands upon a burning Arch, through which, as a Pipe, theſe two furious Neighbours do reciprocally receive the abovesaid Exhalation. This ſeems to me a growing Evil to this wealthy and populous City, and what may poſſibly in time make good the Prediction of *Sanazarius*, who was born here.

Et te, quis putet hæc ? altrix mea, durus Arator
Vertet, & Urbs, dicet, hæc quoque clara fuit.

Yours, &c.

VI. *An*

VI. *An Extract of the Account mentioned in the foregoing Letter, taken out of an* Italian *Paper. Written by* P. Aleſſandro Burgos. *Printed firſt at* Palermo, *and afterwards at* Naples. 1693.

HOW difficult is the Task to deſcribe in a few Pages the mournful *Iliads* of the once famous Kingdom of *Sicilia*, in great part ruined by the terrible Shakes of the late Earthquake? How ſhall I, amongſt the Confuſion of Tears, Sighs and Groans, diſcover the Hiſtory of our Miſery? Or amongſt a Chaos of Rubbiſh find the Marks of our Deſolation? Nay, how can I recall to mind, without Amazement, the Relations that came from all parts of the Deſolate Land? Yet your Commands are to be obey'd.

Quanquam animus meminiſſe horret luctuque refugit
Incipiam------

The Iſland of *Sicilia* of 700 Miles Circuit, and divided into three Valleys, began on *Friday* the *9th* of *Jan.* about half an hour paſt Four a Clock, to be ſenſible of the Shake in the Valley of *Mazara*: But in the two other Valleys of *Emone* and *Noto*, the Shakes were ſo terrible, as to throw down ſome Buildings, obliging the Inhabitants to ſeek Refuge either in the Fields, or with Prayers and Tears implore the Divine Pity in the Churches. On *Sunday* following, being the 11*th* of the ſame Month, at twenty hours and three quarters, the Hand of God appeared much more terrible, awakening the moſt Lethargick Sinner. The Shakes of this Earthquake did no Damage in the Valley of *Mazara*, only frighting the People.

Palermo received ſome Detriment in moſt of the Buildings, eſpecially the Palace and Hoſpital of St. *Bartholomews.* The Steeple of St. *Nicholas*, belonging to the *Augustines*, was ruined, and ſome hurt done to the Church; but little Miſchief elſe done,and no body hurt.

In *Meſſina* all the Buildings of the Theatre are ſhattered, the Royal and Archbiſhop's Palace, with the Seminary, are all crack'd. The vaſt and ſtately Church of the *Franciſcans* broken in many places, and the Roof of the Veſtry fallen: The Steeple of the Church of the Annunciation thrown down, with the Death of the Sexton. The top of the Spire of the *Dome* cleft, all the other Religious Houſes and Publick Buildings were ſaved. Many private Buildings were thrown down, and all the reſt ſhored up. There were but few Perſons kill'd.

Troina, *Randazzo*, *Nicoſia*, Cities in the Mountains, ſuffered in their Buildings. The firſt had half of the Mother-Church deſtroyed, with the Pariſh Church of St. *Lucy*, and was much damaged in his Monaſteries; one whereof is not habitable. The laſt had its *Dome* very much hurt. *Caſtiglione* had the Caſtle and many Houſes thrown down. In *Francavilla* and *Linguagroſſa*, the greater part of the Buildings and ſome Churches. *Maſcali* quite ruined, but not many killed, moſt of the People being abroad a Proceſſion with the Reliques of St. *Leonard* their Protector.

Aidone received a conſiderable Miſchief, two whole Quarters, with many of its Inhabitants being deſtroyed. In the Quarter of St. *Laurence* there is not one Houſe ſtanding, and the Churches ruined. In that of St. *James* the Church of the *Annunciation* and its Oratory thrown down, with ſeveral other Sacred Edifices. In the other part of the City which ſtands lower, there were not ſo many Houſes nor Perſons loſt, yet the Church of

Pope *Leo* is quite flat, and the magnificent Church of the *Dominicans* in Ruines, with the Convent of the *Reformati Oſſervanti*, one of the beſt in the whole Province.

Abi Aquilea, commonly called *Jaci Reale*, ſituated at the Foot of *Etna* is almoſt quite deſtroyed, and its Inhabitants buried in the Ruines, with many Convents; amongſt the reſt, the famous one of the *Oſſervanti Reformati*. *Aci St. Antonio*, *Aci St. Filippo*, *S. Gregorio*, *Pedara Trecaſtagni*, *Bonnacorei*, *Nicoloſi*, *Motta*, *Meſterbianco*, *Fenicia*, and ſeveral other fruitful Villages ſituated near *Mongibello*, are deſtroyed, with all the Habitations of the pleaſant Hills about *Cananea*, which are now in the Duſt.

Paterno, about Twelve Miles from *Catania*, a populous City at the foot of *Mongibello*, ſubject to the Dutchy of *Montalto*, felt the dreadful Effects of the Earthquake, looſing moſt of its Buildings, all the Convents of Fryars, and a very fine Monaſtery. In the Ruines were buried Forty Perſons. *Aderno*, a City ſubject to the ſame Lords, had the ſame Fate.

Cantabiano Piemonte in the Valley of *Emona*, *Francofonte*, *Palagonia* in the Valley of *Noto* are little leſs than wholly level'd, and about 300 Perſons deſtroyed, as we have by the Letter of the Marqueſs of *Francofonte*, who was miraculouſly ſaved by leaping out through the Crack in the Wall of the Falling Edifice.

Catania, one of the moſt ancient and famous Cities of the whole Kingdom, honoured by the Courts of ſeveral Monarchs, and an Epiſcopal See, even from the time of the Apoſtles, giving place to none in the Beauty of its Sacred Edifices; amongſt which the *Dome* was the moſt ſumptuous and large in all *Sicily*, adorned with excellent Pictures, and richly furniſhed, and bleſs'd with the Reliques of the Invincible Martyr St. *Agatha*, honoured with the Bodies of ſeveral Kings; beſides it had a very high and curiouſly built Steeple. Here were a great many Nunneries; amongſt the reſt, the Monaſtery of the Trinity, and that of St. *Benedict*, with that Prodigy of Workmanſhip the magnificent Monaſtery of St. *Nicholas*, with its Temple, a place famous for ſeveral Reliques. Next the Jeſuits Colledge, the Convent of the *Minorites*, and two of the *Dominicans*, the beautiful one of *Capuchins*, the Imperial Convent of the *Carmelites*, that of the Reformed *Minorites*, that of the Reformed *Auguſtines*, with ſeveral other Frieries, with an infinite number of Ancient and Modern Churches, Colleges, and other Publick Buildings, inhabited by about 23000 Souls, its Nobility many and ancient. Learning was here in its Glory; the Citizens were themſelves Learned, and Lovers of Knowledge, aſſiſted with the many Priviledges granted by the King. The Univerſity, where the Learned Laurel was confer'd on the worthy, made this place the *Sicilian Athens.* This once ſo famous, now unhappy *Catania*, had the greateſt ſhare in this Tragedy. Father *Antonio Serrovita*, who was to preach at *Catania* the Lent following, was on his way thither on the 11th, at 20 hours and $\frac{1}{4}$, and at the diſtance of a few Miles; he obſerved a black Cloud like Night hovering over the City; that there aroſe from the Mouth of *Mongibello* great Spires of Flame, which ſpread themſelves all round, that the Sea all of a ſuddain began to roar, and raiſe it ſelf in ſwelling Billows, that there was a very great and dreadful Blow, as if all the Artillery in the World had been at once diſcharged; that the Birds flew about aſtoniſh'd in the Air; that the Beaſts and Cattle in the Fields ran crying about affrighted; that his and his Companions Horſes were ſo ſtartled, that they ſtood ſtock ſtill, trembling ſo as they were forced to alight, which they had no ſooner done, but they were lifted from the Ground above two Palms; and caſting his Eyes toward *Catania*, he with Amazement ſaw nothing

thing but a very thick Cloud of Duſt in the Air. This was the Scene of their Calamity. For of the magnificent *Catania* there is not the leaſt Foot-ſtep to be ſeen. All its Edifices are levell'd with the Ground, except the Chappel of St. *Agatha*, the *Rotunda*, the Caſtle of *Urſino*, the Walls that encompaſs'd it, and a few mean Houſes. There was a very great Deſtruction of the Inhabitants buried in the Ruines of the Biſhop's Palace; the Steeple and *Dome*, where moſt of the City, frightned with *Friday*'s Earthquake, were got together to carry the Reliques of St. *Agatha* in Proceſſion. Many of the Nobility were ſaved under the Chappel of the Saint, and ſome of the Clergy. The number of the Dead was about 15000; for though the People had ſtaid in the Fields all the *Saturday*, yet the Solemnity obliged them to be in the City on the *Sunday* to pay their Devotions, at the Proceſſion. Of the *Benedictines* about 25 were killed in the Quire, of the *Jeſuits* 21, of the *Conventuals* 11, the number of the *Dominicans* is not known; the *Carmelites* were all buried except one as they went in Proceſſion; and ſo were the greater part of the other Religious Orders, and of the Nuns few were ſaved. This was the Tragedy of *Catania*, which was accompanied with dreadful Lightnings and Thunder from Heaven, with Deluges of Rain; and in the Ruines were heard nothing but Cries, Schrieches and dying Groans. On the Heaps of Stones we may now write, *Here was* Catania.

Lentini, a very ancient City, honoured with the Births of many Illuſtrious Perſons; amongſt the reſt, that Father of Eloquence, *Georgio ~~Leontino~~*~~, of a~~ long time an Epiſcopal See, &c. felt that Shock on the 9th with ſuch Violence, as threw down and ruined the greater part of its Buildings; amongſt which was the ancient Convent of *Minorites*, famous for being the Dwelling-place of St. *Anthony* of *Padua*; the *Royal Convent*, ſo called from the Tomb of one of our Queens buried there, under the Ruines of which 4 Religious were buried, the reſt eſcaped miraculouſly. But the laſt Earthquake on the 11th laid in the Duſt the remainder of the City, with the Death of about 4000 People that returned thither after the firſt Shake to take care of their Goods. So that there is now but the Carcaſe of a City all ſhatter'd to pieces, not one Houſe left ſtanding.

Carlentine, a Modern City, being as a Citadel dependent on *Lentine*, had the ſame Fate. The beautiful Caſtle of *Licodia* all ruined, with the Marchioneſs of *Martini* and all her Children buried therein.

Bizrini, a City of rich Inhabitants, is level'd with the Ground, with the Death of many People; part by the firſt, and the reſt by the laſt day's Earthquake.

Sortino and *Caſſero* are quite demoliſh'd; in the firſt about 3000 periſh'd, and in the other a very great number.

Agoſta, a Trading Town, built on an Iſland in a large Bay, which makes a capacious Port, was all blown up into the Air; for beſides the Damage of the Earthquake, there was a great quantity of Powder in the Caſtle that took Fire, and killed ſeveral of the Citizens that had eſcaped into the Fields with the Stones of the Buildings: Here periſh'd about 3000. The enraged Sea grew terribly boiſterous, and tempeſtuouſly beat againſt the Walls of the *Dominican* Convent with ſuch Fury, that ſome Galleys belonging to the Knights of *Malta* ſcarcely eſcaped Shipwrack in the Port. In fine, *Luctus ubique pavor, & plurima mortis imago.* The Country of *Mililli* in the Dutchy of *Montalto*, felt the ſame Fate, with the Deſtruction of the Inhabitants.

Syracuſa, famous in old time, an Epiſcopal See; in our time like the Phænix ariſing from the Aſhes, ſtanding upon a Peninſula, by Art made an Iſland, having a Bridge to the main Land; ſtrengthened with a Modern

Fortification, ſufficiently populous by reaſon of its convenient Situation for Trade, full of Nobility, and beautify'd with Churches, Convents, Monaſteries and Palaces, now mourns in Ruines. It was ſenſible of *Friday's*, but all ſhook to pieces by the *Sunday's* Earthquake, with the loſs of many Thouſand Perſons. Moſt of the Nobility ſaved themſelves by a timely Flight. Of the Religious not many periſh'd. Scarce a Village in the whole Dioceſs is left: Confuſion reigns every where; and the Miſery is encreaſed by the want of Food, cauſed by the Granaries and Mills being deſtroyed.

Laſerla, *Palazzuolo* and *Buſceni* lie in Ruines, with many Inhabitants deſtroyed.

Spacaforno, a populous place, ſituated near the Sea, which waſhes the Foot of the Promontory *Pachino*, has loſt all its Buildings: Here they reckon about 2000 dead.

Giarratana with its Fall killed moſt of the Inhabitants. The Marqueſs himſelf with his Wife and Three Children eſcaping on *Friday*, were on *Sunday* buried in the Ruines; the Marqueſs and his Children were taken out alive to bewail the loſs of his Lady.

Melitello in the Valley of *Noto* is ſhaken to pieces, the Churches and chief Buildings even with the ground, and the Religious Orders all turned out in the open Air, or under Huts and Cabines.

Occhiula eſcaped not the common Calamity.

Mineo, an ancient City, is now no more; and the greater part of the Citizens and Religious.

Caltagirone, a City conſpicuous for its Senate and Nobility, ſuffered in this univerſal Calamity the total Ruine of its proud Edifices: As the principal Church with its very high Steeple or Spire, the Famous Colledge of St. *Julian*, the Temple of St. *George*, the Pariſh-Church of St. *James*, admired for the Pictures of *Epiphanius*, the Chappel only remaining, with the Image and Reliques of the Saint. The Temple of the *Conventuals* thrown down, the famous Bridge that joyns the Convent to the Town ſhattered to pieces, and the Dormitories not to be inhabited ; the famous Convent of St. *Bonaventure*, the fall of whoſe Temple and Spire was the Deſtruction of the lower Buildings; the Colledge of the Jeſuits, and the Steeple of that Noble Church are quite ruined. The *Carmelites*, *Dominicans*, *Auguſtines*, *Crouched Friars*, &c. are all without Churches and Convents. The Monaſteries of St. *Gregory*, St. *Chiara*, St *Salvator* and St. *Stephen*, with a Conſervatory of Orphans, are all ſhook down. In fine, the Senate-Houſe, adorned with moſt curious Statues, and all the other Buildings, are either fallen, or threaten a ſudden Ruine in theſe Deſolations. About 1000 People were loſt.

Modica, a populous place, and chief of the Seigniory of the Admiral of *Caſtile*, has its Buildings and Famous Caſtle laid in the Duſt. Seignior *Abbot Frederick* the Procurator General ſaved himſelf in the Colledge of the Jeſuits, from whom we have the Account; and that the Cities of *Raguſa*, *Scicli*, and *Chiaramonte* had the ſame Misfortune.

Comiſo ſuffered much in its Buildings, though but few were killed. The Convent is down, but the Church ſtands.

Noto, an ancient and ingenious City, full of Nobility and fine Buildings, Convents and Monaſteries, as we hear by a Courier from thence, is all ruin'd; the Convents of the *Dominicans*, *Conventuals*, *Reformati*, *Carmelites*, and *Capuchins*, which was indeed a wondrous Fabrick, are all torn to pieces. The Church of the Crucifixion, the *Dome*, and all the Nunneries are down, with the Deaths of many Citizens and Nobles.

To conclude, there is not a Corner in all the Valley of *Noto* that is not ruined wholly, or for the moſt part, with a dreadful Slaughter of the People. The Southern Coaſts, as *Licati*, *Terra Nova* and *Gircuti* have ſuffered Damage in their Buildings. And all the Caſtles of the Valley of *Emone* near *Mongibello* are crack'd and broken, or fallen down.

This is the Tragedy of *Sicilia*. His Excellency Seignior *Vicere* has given prudent and neceſſary Orders from *Palermo* for the Relief of the afflicted and miſerable Remains of an amazed and half-dead People.

VIII. *An Extract of a Letter from Mr.* Anth. Van. Leeuwenhoek, *containing ſeveral Obſervations on the Texture of the* Bones *of Animals compared with that of Wood: On the Bark of Trees: On the little Scales found on the* Cuticula, *&c.*

I Some years ſince writ Mr. *Oldenburgh*, That I conceived the Bone to be conſtituted of Globules; but finding my Miſtake, I retracted that Opinion: For what I then took for Globules, was the tops of the Tubes or Cilinders whereof the Bone is compoſed.

Not ſatisfied with my Obſervations thereon, I continued my Endeavours to diſcover the true Texture of Bones; and at length found plainly in the Thigh Bone of an Ox, that it conſiſted of four ſorts or ſizes of Tubes, whereof ſome are ſo very ſmall and cloſe united, as not eaſily to be diſcerned in a Bone cut a-croſs, though with an extraordinary ſharp Knife, nothing but Globules appearing: But when it is broken, ſome Shivers are ſeparated, in which theſe *Tubuli* may be ſeen.

Another ſort of theſe *Tubuli* (of which ſome are ſix times bigger than the other) are yet hard to be diſcovered; for though the Knife be very ſharp, yet by reaſon of the hardneſs of the Bone many Particles of them are broken and ſqueezed together, ſo as the Mouths of the little Tubes are cloſed up.

A Third ſort much larger than the former, had nevertheleſs their Mouths ſcarce diſcoverable; but I found them placed in ſuch an Order, as convinced me, that the Ring of theſe *Tubuli* was the Augmentation of the Bone, as I had formerly diſcover'd it to be in Wood, eſpecially when I ſaw, at a little diſtance, another Circle or Ring of *Tubuli*.

A Fourth ſort exceeded the former very much, and were fewer; ſo that in the ſpace of three or four Sands I did ſcarce find one of them.

I have repreſented as well as was poſſible a ſmall bit of an Oxes Thigh Bone, as it ſhew'd before my Glaſſes, *Fig.* 6. *A B C D*, the bit by the naked Eye was not bigger than the little Spot, *Fig.* 7. *E F G* is the Point of a ſmall Needle on which the bit of Bone was ſtuck. I could not obſerve the firſt and leaſt ſort of *Tubuli* in this little bit; for when the Bone is thus cut, the ends of the ſmall Tubes are but confuſedly to be ſeen, like irregular Globules. But the ſecond ſort look like little dark Specks, their Cavities being ſtopt, by cutting which are ſcarce to be diſcerned, eſpecially if the Knife does not cut them at very true right Angles; for if it be ever ſo little aſlope, it is impoſſible to diſcover theſe Veſſels. They are repreſented Letter *H H H*.

The third ſort of *Tubuli* are ſhewn by Letter *I I I*, and there I found not only placed in Circles orderly, but likewiſe in a different manner, as the large Veſſels are in Wood.

The fourth ſort of Tubes large, in compariſon of the reſt, are repreſented by *K K*. *L M* are ſeveral cracks or clefts in the Bone cauſed by the Preſſure of the Knife, eſpecially if it be not very ſharp.

Beſides the above-mentioned four ſorts of Tubes running the length-ways of the Bone, I ſometimes imagin'd I ſaw ſome in a contrary Situation, which ſeemed to proceed from the middle of the Bone, and terminate at the circumference; and that theſe were of two ſizes, whereof the ſmaller were ſuch as the above-mentioned leaſt ſort, that for the moſt part make up the length of the Bone. The Reaſon why I could not well diſcover theſe, was, from their being at a great diſtance from each other; and ſome ſeemed as if perforated by thoſe that run the length-ways. And though I could not be certain I ſaw theſe radiated *Tubuli*, yet I do not queſtion their being there; and I ſuppoſe the *Perioſteum* is moſtly conſtituted and nouriſhed by theſe; the rather, ſince we ſee the ſame in Trees, whoſe Bark is formed by the tranſverſe Fibres that run from the Center paſſing between the direct ones. And as we cannot determin the beginning of the Bark in the Tree, becauſe it is annually formed anew out of all the Horizontal Veſſels; ſo I conceive that the Membranes ſurrounding the Bones have their encreaſe from ſome Veſſels proceeding from the cavity of the Bone to the circumference, where they are dilated into that thin ſoft Skin defending the Bone as the Bark does the Tree.

I know many believe the Origine and Nouriſhment of the Bark is from the Root; but if it were ſo, we ſhould find the parts of the Bark near the Root larger, and ramify'd into ſmaller and ſmaller as they run higher, as the Arteries and Nerves are, the further they go from the Heart and Brain; whereas there is no difference between the Veſſels of the Bark of the Root and Trunk: Beſides, the Veſſels of the Bark of ſeveral Trees, as the Birch, Cherry, Peach, &c. run not upwards as they do in the Aſh, Oak, Elm, Nut, Apple, Pear, &c. but Circularly round the Superficies of the Tree. And all Bark whoſe Veſſels run upwards, grows thicker as the Tree increaſes, the outſide cracking grows Dead, and ſticks to the young Bark underneath, which is the only living Part of the Bark. The contrary is evident in thoſe Barks whoſe Veſſels run round the Tree; for as the Tree increaſes the Veſſels not being able to Stretch nor Separate from each other, muſt neceſſarily break aſunder; ſo that the Old Bark is eaſily Separated and falls off from the New. Wherefore ſuch Trees have always a very thin Bark, as is moſt evident in the Birch Tree.

And as we ſaid of the Bark, that it is produced and nouriſht from the Trunk of the Tree, ſo is it in the Production of the Skin of Animals, which is covered over with the Scarf-skin, conſiſting of Scaly Particles: For having examined the Skin of many Animals, it ſeemed to me to be formed by the wondrous interweaving of all the extremities of the Veſſels that proceed to the extream parts of the Body; from the ends of which, a certain matter iſſues forth forming the Scales; the extremities terminating at thoſe Scales which ſo long ſtick faſt to the Veſſels, till new ones diſplace them; and once in the Skin of a very Fat Dog, I found a great number of Fat-globules between the branches of the Veſſels that conſtitute the Skin.

Theſe Obſervations brought me to Examine again the Scales that cover our Bodies, to find if it were poſſible whether they were not formed after the ſame manner as thoſe of Fiſhes: and indeed each Scale of our Body is compoſed of a great company of Veſſels, interwoven together after the ſame manner as the Scales of Fiſh. Provident Nature as I have often found, performing her Operations uſually after the ſame Method.

I therefore applied my utmoſt endeavours, in this Examination of the Scales of our Body, and judged thoſe of the Mouth to be the fitteſt for that purpoſe, for that they not being dryed are more eaſily ſeparable from the Skin, and from each other: Examining theſe divers times, I ſtill found a clear ſpot in the middle of them, ſtanding up above the reſt of the Scale (which I had obſerved before often, but thought it accidental) whence I concluded, that the Scales, not only of the Mouth but the whole Body, were compoſed as thoſe of Fiſhes, of Veſſels, proceeding to this clear Part, and nouriſhing the Scales which grow from thence.

Now as to the Tranſpiring Parts of our Bodies, I have formerly ſaid the moiſture was exhaled from the Veſſels placed between the Scales; but now I find the number of the Veſſels, far to exceed what I then thought, ſo that by the motion and heat of the Body, there may a very great quantity of ſweat be expelled by ſo many Veſſels; the number of which I endeavoured to Calculate, by laying ſome of the Scales of my Skin by ſome Sands, ſo to find their comparitive magnitude, and found the Axis of ſome larger Sands, 20 times, of others 15, and of others 10 times bigger than the Diameter of a Scale: Theſe Scales are placed in a triple order upon one another: I took therefore the leaſt of them and thus computed: 250 Scales as aforeſaid are covered by one Sand, ſuppoſe then every Scale to conſiſt of 500 Veſſels, then will the moiſture in the ſpace of a Sand be thruſt out at 125000 ſeveral little Pores, not reckoning the mouths of the Veſſels between the Scales.

Examining the Scales of the Skin of my Arm I found a ſpot in the midſt of ſome of them, but not ſo diſtinctly as in thoſe of my Mouth.

I cannot well omit (in this place, relating to Tranſpiration) what ſome time ſince happened to me; which was an extraordinary itching on the upper part of my Noſe, which viewing with an enlarging Looking-glaſs, I found a whitiſh ſcurfy ſpeck which I took off, but not without ſome pain, it ſtuck ſo firmly to the Skin; obſerving it with my Microſcope, I found the reaſon of its Scurfineſs, and of its ſticking ſo faſt; for this bit of the skin conſtituted of Scales, was thick beſet with little *Conical* Bodies, cauſed as I judged by a more than ordinary expulſion of a thick *Matter* or *Pus* in this place, which not being able to paſs through the Scales, much leſs through the Veſſels of the Scales, had made ſeveral pits or dents in the Skin, and forceably raiſed and torn off the Scales from the Skin, both which had cauſed the Itching and made the white ſcurfy ſpeck, ſome part of the true skin being ſeparated: and the little pain that I felt was cauſed by the faſt ſticking of the *Conical* Bodies to the Skin, which in ſeparating were torn there-from; but what ſeemed ſtrange to me, was that in a Days time, and ſometimes ſooner, a new ſcurfy Particle was formed like the former, beſet with the ſame pointed parts, and this 6 or 8 times one after another, as faſt as I took them off. I have given the Figure of this little bit of Skin, having never obſerved the like where I might well expect it, *viz.* in Leprous Perſons, whoſe Diſeaſe is a ſcurfy ſeparation of the Skin.

Fig. 8. is the bit of Skin of the true ſize by the naked Eye. *Fig.* 9. *A B C D* the ſame magnified, in which the Conical Bodies formed out of the Matter or *Pus* are obſervable. *E* a little hole in the *Cuticula*, through which a ſmall hair grew. The under ſide of the little bit of the *Cuticula* which ſtuck to the true Skin is here repreſented.

VIII. *A Propoſal concerning the Parallax of the Fixed Stars, in Reference to the Earths Annual Orb. In ſeveral Letters of* May *the* 2d, June 29. *and* July 20. 1693. *from Dr.* John Wallis *to* William Molineux *Eſq;*

SIR,

I Am obliged to you for two Books which you have been pleaſed to ſend me, that of your *Sciothericum Teleſcopicum*, and that of *Dioptricks*; which you have performed ſo well, that I have not been better ſatisfied with any that I have ſeen of that Subject. I ſhould not ſo long have neglected to return my Thanks for them, but that I thought a Letter of bare Thanks to be too empty, unleſs I had ſomewhat elſe to ſend with it.

You will, I hope, give me leave (though I have not had the opportunity of being perſonally known to you) to ſuggeſt a Speculation, which hath been in my Thoughts theſe Forty Years or more; but I have not had the opportunity of reducing it to Practice, as being not ſo well ſtored with neceſſary Inſtruments of that kind, nor much exerciſed to Teleſcopick Obſervations. And though I have many Years ſince ſuggeſted it to others, yet neither have they had leiſure or convenience of putting it in Practice.

It is concerning the Parallax of the fixed Stars, as to the Earths Annual Orb.

Galileo complains of it a great while ſince (in his *Syſtema Coſmicum*) as a thing not attempted to be obſerved with ſuch diligence as he could wiſh, and I doubt we have the ſame cauſe of complaining ſtill. I know that Dr. *Hook* and Mr. *Flamſtead* have attempted ſomewhat that way, but have deſiſted before they came to any thing of Certainty. What hath been done to that purpoſe abroad I know not.

Galileo hath ſuggeſted divers things conſiderable in order to it.

As to the times of Obſervation; That it ſhould be when the Sun or Earth are in the Tropicks, or as near thereto as may be: Becauſe at thoſe times, if any, will be the greateſt difference obſervable in their Meridional Altitude.

As to the Stars to be obſerved, That they ſhould be ſuch as are as near as may be to the Pole of the Ecliptick: For ſuch as are in the Plain of the Ecliptick, or near unto it, though they may be ſometime nearer, ſometime farther from us, (which might ſomewhat alter their apparant Magnitude, if it were ſo much as to be obſervable) yet it would little or nothing alter the Parallactick Angle, as *Galileo* doth there demonſtrate.

He notes alſo, that in a buſineſs ſo nice, the ordinary Inſtruments of Obſervation (though pretty large) would be inſufficient (he doubts) for this purpoſe, and doth propoſe, that by the ſide of ſome Edifice or Mountain, at ſome miles diſtance, the ſetting of ſome noted Star (as that of *Lucida Lyræ*) might be obſerved at thoſe different times of the Year, which might be equivalent to an Inſtrument whoſe Radius were ſo large.

Which were a good Expedient if Practicable; but I doubt the Denſity of our Atmoſphere is ſo great, as that it will be hard to diſcern a Star juſt at the Horizon, or even within ſome few Degrees of it: And that the Refraction would be there ſo great, and ſo uncertain, as not to comply with ſo curious an Obſervation.

That which occured to my Thoughts upon theſe Conſiderations, was to this purpoſe; That ſome Circumpolar Stars (nearer to the Pole of the Equator than is our Zenith, and not far from the Pole of the Zodiack) ſhould be made choice of for this purpoſe. And in caſe the Meridianal Altitude be diſcernably different at different times, ſo will alſo be their utmoſt Eaſt and Weſt Azimuth, which may be better obſerved than their Riſing or Setting: And this will be not obnoxious to the Refraction, as is the Meridional Altitude; (for though the Refraction do affect the Altitude, yet not the Azimuth at all); and we may here have choice of Stars for the purpoſe; which in Obſervations from the bottom of a Well we cannot have; being there confined to thoſe only which paſs very near our Zenith, though very ſmall Stars.

I would then take it for granted, as a thing at leaſt very probable, that the Fixed Stars are not all (as was wont to be ſuppoſed) at the ſame diſtance from us; but the diſtance of ſome, vaſtly greater than of others; and conſequently, though as to the more remote, the Parallax may be undiſcernable; it may perhaps be diſcernable in thoſe that are nearer to us.

And thoſe we may reaſonably gueſs (though we are not ſure of it) to be neareſt to us, which to us do appear biggeſt and brighteſt, as are thoſe of the Firſt and Second Magnitude; and there are at leaſt of the Second Magnitude, pretty many not far from the Pole of the Ecliptick, (as that in particular, in the Shoulder of the leſſer Bear): And in caſe we fail in one, we may try again and again on ſome other; which may chance to be nearer to us than what we try firſt. And Stars of this bigneſs may be diſcerned by a moderate Teleſcope, even in the day-time; eſpecially when we know juſt where to look for them.

The manner of Obſervation I conceive, may be thus: Having firſt pitched upon the Star we mean to obſerve, and having then conſidered (which is not hard to do) where ſuch Star is to be ſeen in its greateſt Eaſt or Weſt Azimuth; it may be then convenient to fix (very firm and ſteadily on ſome Tower, Steeple, or other high Edifice (in a convenient ſituation) a good Teleſcopick Object-glaſs in ſuch poſition, as may be proper for viewing that Star. And at a due diſtance from it near the Ground, build on purpoſe (if already there be not any) ſome little Stone Wall, or like place, on which to fix the Eye-glaſs, ſo as to anſwer that Object-glaſs: And having ſo adjuſted it, as through both to ſee that Star in its deſired Station, (which may beſt be done while the Star is to be ſeen by Night in ſuch ſituation, near the time of one of the Solſtices), let it be there fixed ſo firmly, as not to be diſturbed, (and the place ſo ſecured, as that none come to diſorder it), and care be taken ſo to defend both the Glaſſes, as not to be endangered by Wind and Weather. In which contrivance I am beholden to Mr. *John Caſwel* M. A. of *Hart-hall* in *Oxford*, for his Advice and Aſſiſtance; with whom I have many Years ſince, communicated the whole matter.

This Glaſs being once fixed (and a Micrometer fitted to it, ſo as to have its Threds perpendicular to the Horizon, to avoid any inconvenience which might ariſe from diverſity of Refraction if any be) the Star may then be viewed from time to time (for the following Year or longer) to ſee if any change of Azimuth can be obſerved.

This I thought fit to recommend to your Conſideration, who do ſo well underſtand Teleſcopes, and the managery of them; not knowing any who is more likely to reduce it to Practice. If you ſhall think fit to give your ſelf the trouble of attempting the Experiment, and that it ſucceed well, it will be a noble Obſervation, and worth the Labour: And, if it ſhould miſcarry, the charge I hope would not be great.

But when I ſuggeſt (as a convenient Star for this purpoſe) the ſhoulder of the leſſer Bear (as being the neareſt to the Pole of the Zodiack of any Star that is of the firſt or ſecond Magnitude), I do not confine you to that Star; but (without retracting that) ſuggeſt another; namely, the middle Star, in the Tail of the Great Bear, which (though ſomewhat farther from the Pole of the Zodiack) is a Brighter Star than the other, and may be nearer to us.

But I do it principally upon this Conſideration: namely, That there is adhering to it a very ſmall Star, (which the *Arabs* call *Alcor*, of which they have a Proverbial ſaying, when they would deſcribe a ſharp-ſighted Man; That he can *diſcern the Rider on the middle Horſe of the Wayn*; and of one who pretends to ſee ſmall things but over-look much greater; *Vidit Alcor at non Lunam plenam*): Which *Hevelius* in his Obſervations, finds to be diſtant from it about 9 Minutes, and 5 or 10 Seconds: So that beſides the advantage of diſcovering the Parallax of the greater Star, if diſcernable. The difference of Parallax of that and of the leſſer Star (being both within the reach of a Micrometer) may do our Work as well. For if that of the greater Star be diſcernable, but that of the leſſer be either not diſcernable, or leſs diſcernable. Their different diſtances from each other at different times of the Year, may, perhaps (without farther *Apparatus*) be diſcerned by a good Teleſcope of a competent length, furniſhed with a Micrometer, if carefully preſerved from being diſordered in the Intervals of the Obſervations; and diſcover at once, both, that there is a Parallax, and that the Fixed Stars are at different diſtances from us, wherein, that I be not miſtaken, my meaning is not, that the Inſtrument or Micrometer ſhould be removed for the obſerving of the leſſer Star; but that (when the Azimuth of the greater Star is taken) by a Micrometer (conſiſting of divers fine Threads parallel and tranſverſe) may (at the ſame time) be obſerved the Diſtance of the two Stars, each from other, in that Poſition (both being at once within the reach of the Micrometer ;) which diſtance (the Inſtrument remaining unmoved) if it be found (at different times of the Year) not to be the ſame; this will prove, that there is a *different* Parallax of theſe two Stars.

This latter part of the Obſervation (of their different diſtances at different times) I ſuggeſt, as more eaſily practicable though not ſo nice as the former. For it may be done, I think, without any further *Apparatus* there than a good Teleſcope, of ordinary form, furniſhed with a Micrometer, (this being carefully kept unvaried during the Interval of theſe Obſervations.) And if this part only of the Obſervation (without the other) be purſued ; it matters not though the two Obſervations (near the two Solſtices) be, one at the Eaſtern, the other at the Weſtern Azimuth (whereby both may be taken in the Night-time,) for the diſtance muſt (at both Azimuths) be the ſame, if after obſerving the Azimuth of the greater Star it be neceſſary to move the Micrometer for meaſuring its diſtance from Alcor that may be done another Night (and it is not neceſſary to be done at one Obſervation) for that diſtance cannot be diſcernably varied in a Night or two.

I ſhall give you no farther trouble at preſent, but ſubſcribe my ſelf, Sir, *Yours*, &c.

IX. An Account of a BOOK.

Synopſis Methodica Animalium Quadrupedum & Serpentini Generis Auth. Joanne Raio, *S.R.S.*

THE Excellent Author of this *Synopſis* of Quadrupeds and Serpents, continues to oblige the World with freſh and frequent Specimens, not only of his great Penetration in diſcovering, but of his particular Sagacity in ranging and digeſting the vaſt Body of *Nature* in moſt proper Claſſes and Orders ; whereby the Memory is extreamly aſſiſted, and the Beauty of

the

the Creation illuſtrated. Of this the Worthy Author has already been pleas'd to publiſh very conſpicuous Proofs in the Hiſtories of Plants, Birds, Fiſhes, and perhaps may do more in Inſects.

The Deſign of this preſent Work, intended for a Manual or Pocket-Book, is to reduce all Quadrupeds into the moſt proper and natural Method, for the more eaſie Comprehenſion and Memory of them; and to add to the ſeveral *Species* ſuch ſhort Characterick Notes, as whereby they may be certainly known and diſtinguiſhed from others of the ſame kind.

Firſt of all, there is propoſed the moſt exact diviſion of all Animals in general, which is firſt into *Sanguineous* and *Exanguious*. Under the *Exanguious*, or ſuch as want that red Liquor we call Blood, are comprehended, 1. All *cruſtaceous* Fiſhes, *Crabs*, *Lobſters*, *Shrimps*, 2. All *Teſtaceous* or Shell-Fiſhes, as *Cockles*, *Muſcles*, *Oyſters*, *Scallops*, *Periwinkles*, *Whilks*, &c. as alſo all Land Shell-Snails, 3. Thoſe they call *Mollia*, or Soft-fiſhes, as *Pulps*, *Cuttle-fiſhes*, *naked Snails*, &c. 4. Inſects of all ſorts.

The Sanguineous kind are divided into ſuch as breath by *Lungs*, and ſuch as breath by *Gills*, of which kind are all Sanguineous Fiſhes except the *Whale-kind*. Such as breath by *Lungs* are divided into thoſe that have but *one Ventricle* in the Heart, and ſuch as have *two Ventricles*. Of the former kind are thoſe they call *Oviparous Quadrupeds* and *Serpents*.

The latter are again ſubdivided into *Viviparous*, or ſuch as bring forth living Young, and *Oviparous*, or ſuch as lay Eggs, which are Birds or feathered Foul.

Laſtly, The Viviparous are divided into *Aquatic*, or the *Whale-kind* and *Terreſtrial* (under which the Author comprehends the Amphibious) or *Quadrupeds*; although all viviparous Animals of this kind are not Four-footed, there being one exception, *viz.* The *Manati* or *Sea-cow*, which hath but two Feet. But all of them without exception are hairy, and ſo may be diſtinguiſhed from the *Whale-kind*; all of which have a ſmooth Skin.

Then follows a Diviſion and Table of *Viviparous* Quadrupeds or *Viviparous hairy* Animals: which are either *hoof'd* or *claw'd*.

The *hoof'd* are either *whole-footed*, or *whole-hoof'd*, as the *Horſe* and *Aſs*; or *cloven-footed*. The *Cloven-hoof'd* are either *Biſulc*, ſuch as have the Hoof divided into *two* parts, as the *Ox*, *Sheep* and *Goat*, or *Quadriſulc*, which have the Hoof divided into *four*. The former are either *Ruminant*, ſuch as chew the Cud; or *Non-Ruminant, viz.* The *Hog-kind.* The *Ruminant* are divided in reſpect of their Horns, of which there are three Kinds. 1. The *Beef-kind,* which have four Teats. 2. The *Sheep-kind* which bear Wool, have but two Teats, and wreathed Horns. 3. The *Goat-kind* which have ſtreighter Horns, and are covered with Hair inſtead of Wool; and ſuch as have *ſolid, branched* and *deciduous* Horns, as the *Deer-kind.* The *Claw'd,* have the Foot divided either into *two* Claws, *viz.* the *Camel-kind,* or into *more,* called therefore *Multifidous.*

The *Multifidous* are divided into ſuch as have broad Nails, and a humane Shape, as *Apes* and *Monkeys,* and ſuch as have *narrower* and *pointed* Nails.

Theſe latter in reſpect of their *Teeth* are divided into ſuch as have *many fore Teeth* or *Cutters* in each Jaw; and ſuch as have but *two,* all which laſt are *Herbivorous* or *Phytivorous* Animals, and from the moſt known Creature of this Tribe called the *Hare-kind.*

Thoſe that have *more fore Teeth* or *Cutters* are diſtinguiſhed into *greater,* which have either a *ſhorter Snout,* and round or ſquare Head; or a *longer Snout* and Head: Theſe from their likeneſs to the moſt known Animals of each kind, the *Cat* and the *Dog,* we call the former the *Cat-kind,* and the latter the *Dog-kind:* To the *Cat-kind* belong the *Lion, Tyger, Leopard, Ounce,* &c. to the *Dog-kind* belong the *Wolf, Fox, Badger, Otter,* &c. and *leſſer,* which from their long ſlender Bodies, like to the *Weaſel,* we call the *Vermineous* or *Weezel-kind.*

To the *Cat-kind* are referred ſome anomalous Animals, *viz.* The *Bat,* and the *American* Creature called *Ai* or *Sloth.* To the *Dog-kind* from their having a longer Snout are referred; The *Urchin* or *Hedge-hog;* the *Tatou* or *Armadillo,* the *Mole,* the *Shrew-mouſe* or *Erd,* i. e. *Earth-ſhrew,* the *Tamandua* or *Ant-bear;* which hath no Teeth at all.

Then are briefly deſcribed the ſeveral Species of all theſe kinds in order: and to ſome of them large Anatomical Deſcriptions and Obſervations added. As firſt of the *Uterus* of a pregnant Sow, wherein the Adhæſion of the *Chorion* to the *Uterus* round about is ſhown; and notice taken, 1. Of the two large diaphanous Bladders, one at each end of the *Tunica Allantoides,* into which is a Paſſage out of the *Allantoides,* ſo that the Liquor contained therein may eaſily be impelled into the Bladders, and out of the Bladders back again into the *Allan* *toides*, 2. Of the great quantity of Water contained in the *Allantoides*, more by far then the Urine of ſo ſmall an Animal in ſo ſhort a time can likely amount to, and inquiry made into the Original and Uſe of it. Its likely part of it may be ſeparated from the Blood, and excerned into the Cavity of the Tunicles by certain little Glandules, which the Author obſerved diſſeminated all over the *Chorion*. The *Tubæ uterinæ* or *Fallopianæ* in this Creature are deſcribed; and ſhewn to be when extended at leaſt 9 Inches long. They do manifeſtly perforate the *Cornua uteri*, ſo that a Style or Probe may eaſily be thruſt either upward out of the *Uterus* into the *Tubæ*, or downward out of the *Tubæ* into the *Cornua uteri*, without reſiſtance or the impediment of any Valve.

Secondly, Dr. *Tyſon*'s Deſcription of the *Tajacu* or *American Musk-hog*, recorded in the *Philoſophical Tranſactions*, Numb. 153. is inſerted at large, wherein are many curious Remarks, which I ſhall not mention, becauſe I ſuppoſe they are well known, having been ſo lately publiſhed in theſe Papers.

Thirdly, An Anatomical Deſcription of the *Elephant* by the Learned and Ingenious Dr. *Moulins*, which alſo having by the Author been publiſhed in *Engliſh*, I ſhall for the Reaſon forementioned, forbear to ſet down Particulars.

Fourthly, *Excerpta* out of the Deſcription of the *Ape* ſet forth by *Pariſian* Academiſts, wherein the Differences between the internal and external Parts of the *Ape* and *Man* are obſerved and noted.

It is eſpecially remarked, that though the Muſcles of the *Os hyoides*, or Tongue-bone, the Tongue, the *Larynx*, and *Pharynx*, which eſpecially ſerve for the Articulation of the Voice, be in *Apes* altogether like to thoſe of a *Man*, at leaſt much more than the Muſcles of the Hands, which the *Ape* uſes almoſt as perfectly as *Man* himſelf to all purpoſes; yet is the *Ape* deprived of Speech. Whence it is clear, that Speech is an Action peculiar to *Mankind*, by which he is more diſtinguiſhed from Brutes, than by the uſe of the Hand: neither doth it neceſſarily follow, that natural Agents do perform ſuch and ſuch Actions, becauſe they are furniſhed with Organs proper for the Performance of them.

Laſtly, Such *Sanguineous* Creatures as breath by Lungs, and have but one Ventricle in their Hearts are enumerated and deſcribed. They are of four kinds, 1. *Frogs*, 2. *Tortoiſes*, 3. *Lizards*, 4. *Serpents*: Concerning each of which there are curious Anatomical Obſervations added: But eſpecially a large Deſcription of the outward and inward parts of the *Rattle-ſnake*, compoſed by the fore-mentioned Learned Perſon Dr. *Tyſon*, and publiſhed in theſe Tranſactions, *Numb.* 144. the Particulars whereof I ſhall therefore omit.

Before this *Synopſis* are premiſed ſome Diſcourſes concerning Animals in general.

As *Firſt*, Whether they are meer Machines, or have any Sence and Perception, that is, whether they reflect upon, and are conſcious of what they do or ſuffer. The Affirmative whereof ſeems moſt probable to the Author.

Secondly, Concerning the Generation of Animals there are Three Queſtions diſcuſſed. 1. Whether there be any Spontaneous or Equivocal Generation? The Author's Opinion is, That there is no ſuch thing, but that all Animals, even the vileſt Inſects, are generated by Animal Parents of their own kind. 2. Whether all Individuals of every Species of Animals, that ever were or ſhall be, were at firſt created by God, or whether there are every day new ones produced by Generation? The Author is inclinable to their Opinion that hold all were at firſt created, but not confident of it. Seeing neither Man nor any other Creature is capable of forming ſuch an Engine as an Animal Body; and ſince all Females have in them from their firſt Formation the Seeds of all the Individuals they ſhall during their whole Life bring forth, it is clear they have no power of producing new ones; and a ſtrong Preſumption, that all that have been or ſhall be were at firſt created. 3. Whether the Seeds of Animals, or rather the primordial Animalcules are lodged in the Egg of the Female, or in the Sperm of the Male. The Author is of the former Opinion, for many Reaſons which may be ſeen in the Book.

Thirdly, The Diſtinction of Animals into *Viviparous* and *Oviparous* is conſidered; and it is ſhewn, that if the Word *Viviparous* ſignifies according to the Etymology of it, ſuch as bring forth live Young, then Animals of the ſame *Genus* may be ſome Viviparous and ſome Oviparous: So for Example, Some Serpents, as the *Adder*, are Viviparous, and ſome, as the common *Snake*, Oviparous: But if the Word *Viviparous* ſignifies ſuch Animals as continually afford Nouriſhment to the *Fœtus* during geſtation from the Womb it ſelf: And *Oviparous* ſuch as either lay Eggs, or produce perfect Eggs, that is ſuch as contain all the Nouriſhment of the *Fœtus* till it be excluded, though they retain ſuch Eggs in the Womb till excluſion, affording them only warmth and harbour; then the diſtinction may be of good uſe; and as well ſuch Serpents and Lizards as hatch their Eggs in their own Bodies, as thoſe that lay them in a Dunghil, or other warm place to be cheriſhed and hatch'd by the Heat of the Sun, may be called *Oviparous*.

For the more eaſie and clear Comprehenſion and Diſtinction of the ſeveral Kinds of Animals, Mr. *Ray* gives two *Schemes* or *Tables* of them: The firſt a General one of all Animals; the ſecond a Particular one of Quadrupeds.

Animals are either

- *Sanguineous*, that is ſuch as have Blood, which breath either by
  - *Lungs*, * having either
    - *Two Ventricles in their Hearts*; ** and thoſe either
      - *Viviparous*,
        - *Aquatic*, as the Whale-kind
        - *Terreſtrial*, as Quadrupeds, or in general all hairy Animals.
      - *Oviparous*, as Birds, which have immoveable and perforated Lungs.
    - *But one Ventricle in their Hearts*, as Frogs, Tortoiſes, Serpents.
  - *Gills*, as all Sanguineous Fiſhes except the Whale-kind.
- *Exanguious*, or without Blood, which may be divided into
  - *The Greater*, either
    - *Naked*
      - *Terreſtrial*, as Naked Snails
      - *Aquatic*, as the Poulp or Pour-contrel, *Polypus*; the Cuttle-fiſh, *Sepia*; The Sleave or Ink-fiſh *Lolligo*
    - *Covered*, with a Tegument either
      - *Cruſtaceous*, as Lobſters and Crab-fiſh.
      - *Teſtaceous*, whether *Univalve* as Limpets, or *Bivalve*, as Oyſters, Muſcles, Cockles; or turbinate, as Periwinkles, Snails, *&c.*
  - *The leſſer*, as Inſects of all ſorts.

* Gills and Lungs differ in that Gills are but as it were inverted Lungs: The Air being drawn inwardly into the Lungs, whereas it only outwardly touches or ſlides by the Gills.

** Animals that have two Ventricles in their Hearts uſe a frequent and conſtant inſpiration and exſpiration, taking in and breathing out the Air. But thoſe that have but one Ventricle uſe no ſuch frequent inſpiration and exſpiration; but receive in and retain the Air a conſiderable time in their Lungs before they breath it out again.

A TABLE *of Viviparous hairy Animals or Quadrupeds.*

Viviparous Quadrupeds or Viviparous hairy Animals are either

- *Hoof'd*, which are either
  - *Whole-footed* or hoof'd, as the Horſe and Aſs.
  - *Cloven-footed*, having the Hoof divided into
    - *Two principal parts*, called *Biſulca*, either
      - *Such as chew not the Cud*; as all ſorts of Swine
      - *Ruminant, or ſuch as chew the Cud*, divided into
        - *Such as have perpetual and hollow Horns*, of which there are three Kinds, *viz*. 1. The *Beef-kind*. 2. The *Sheep-kind*. 3. The *Goat-kind*.
        - *Such as have ſolid, branched and deciduous Horns*; as the *Deer-kind*.
    - *Four parts*, which we call *Quadriſulca*; as the Rhinocerot and *Hippopotamus*.
- *Clawed*, or Digitata, having the Foot divided into
  - *Two parts* or Toes, having two Nails, as the *Camel-kind*.
  - *Many Toes or Claws*; either
    - *Undivided*, ſticking all together, covered with a common Skin, the tips of the Toes only peeping out or appearing outwardly, and being covered with Nails, as the *Elephant*.
    - Divided from each other a good way down, which have either
      - *Broad Nails* and an *Humane Shape*, as Apes and Monkeys.
      - *Narrower and more pointed Nails*; in which in reſpect of their Teeth are divided into ſuch as have
        - *Many fore Teeth or Cutters in each Jaw*, either
          - *The greater*, which have
            - *A ſhorter Snout and rounder Head*, which we call the *Cat-kind*.
            - *A longer Snout and Head*, which we call the *Dog-kind*
          - *The leſſer*, with a long ſlender Body, and ſhorter Legs, which we call the *Vermine* or *Weezel-kind*.
        - *Only two large and remarkable fore Teeth*, all which are Phytivorous. Theſe we call the *Hare-kind*.

For all which, and the many ſubordinate Species under each Genus; together with ſhort Hiſtories of them, the Book it ſelf muſt be conſulted.

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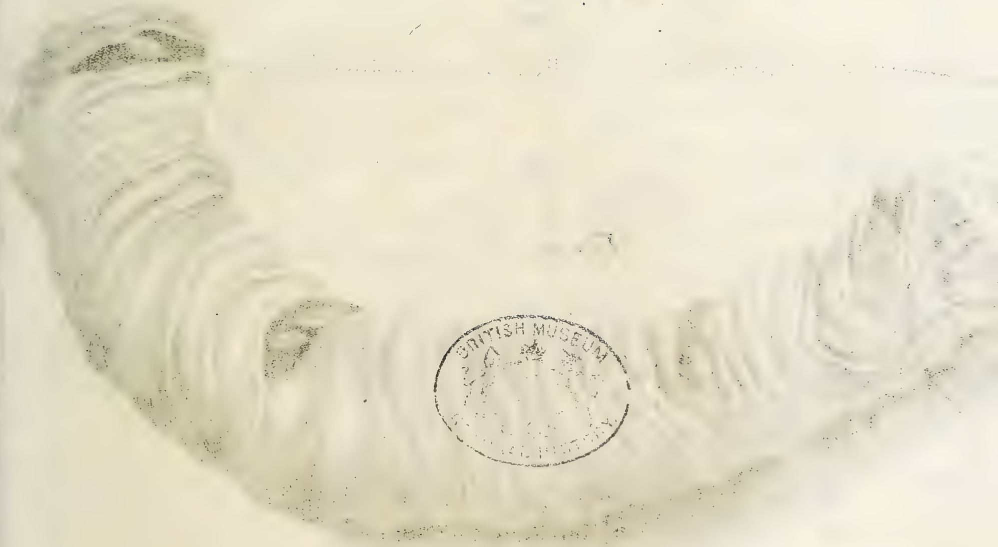
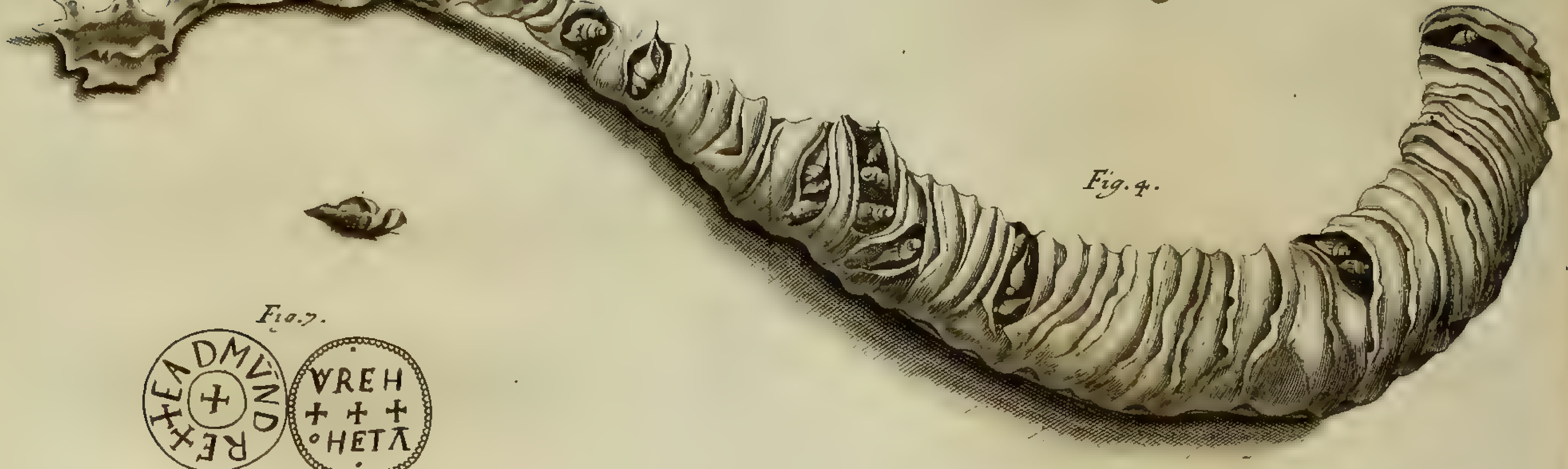


BRITISH MUSEUM NATURAL HISTORY

Fig. 1.

Fig. 2.

Fig. 3.



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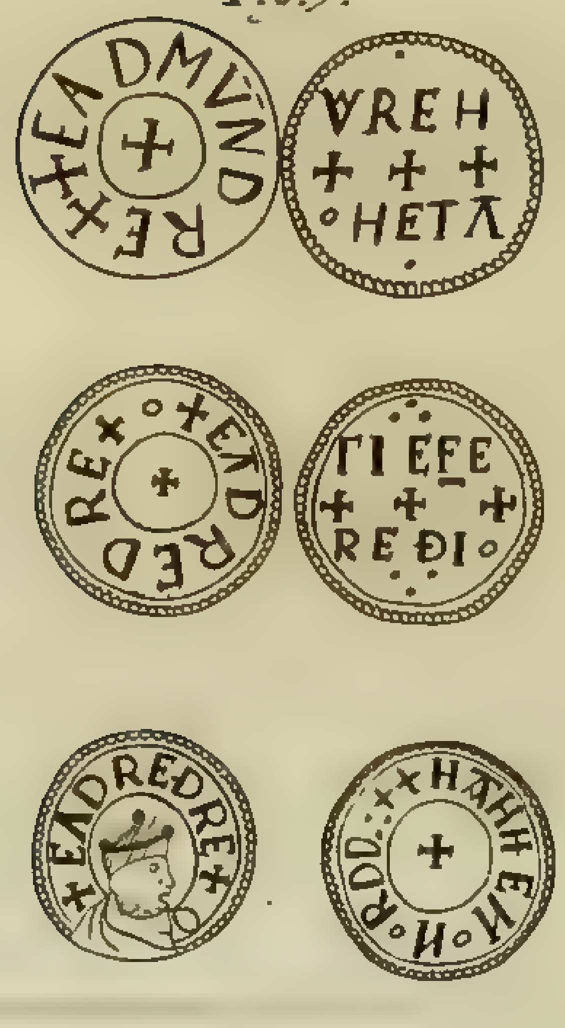

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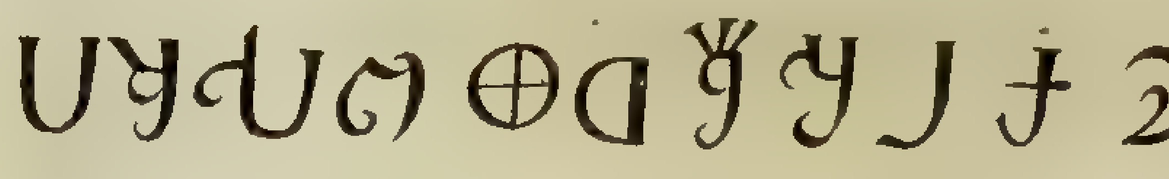

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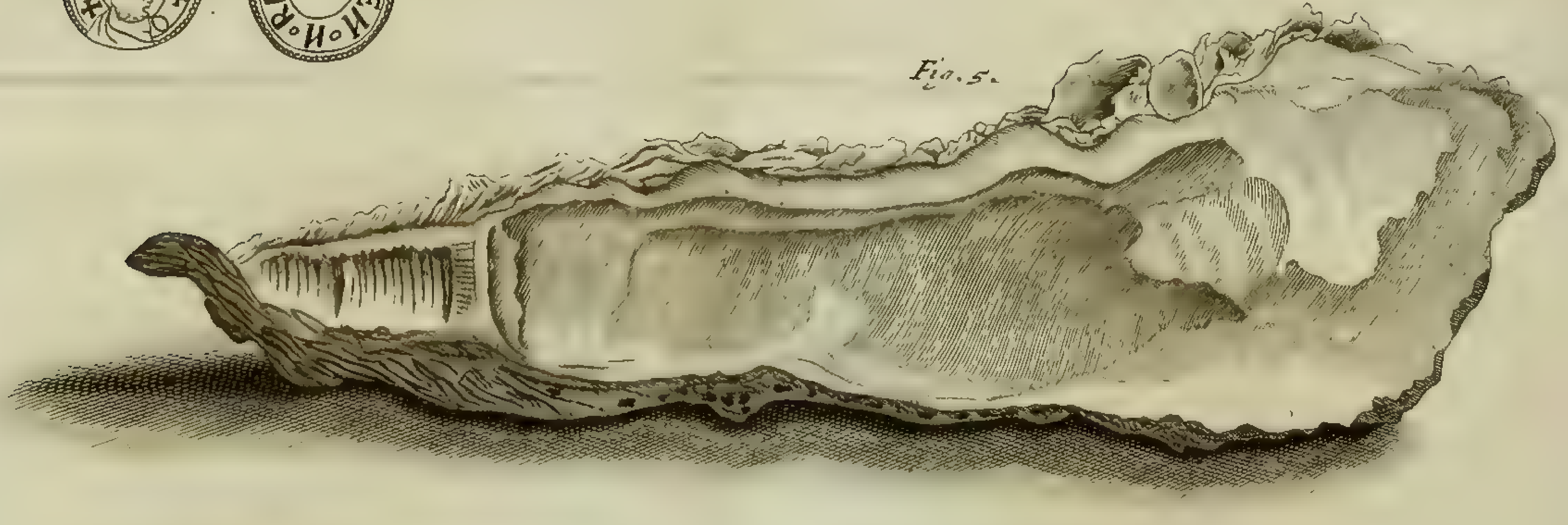

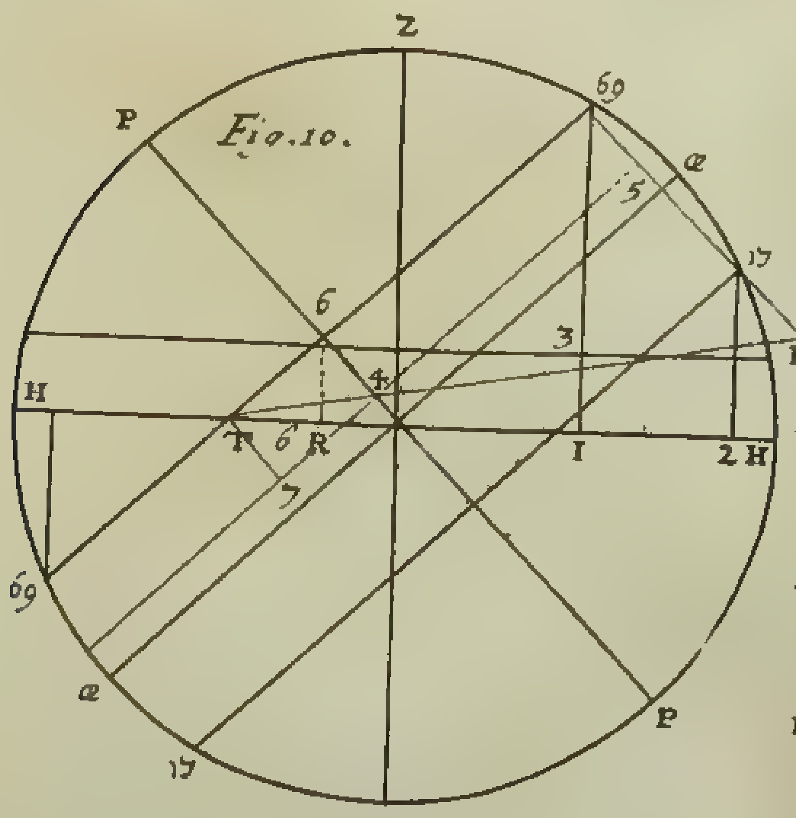

Fig. 10.

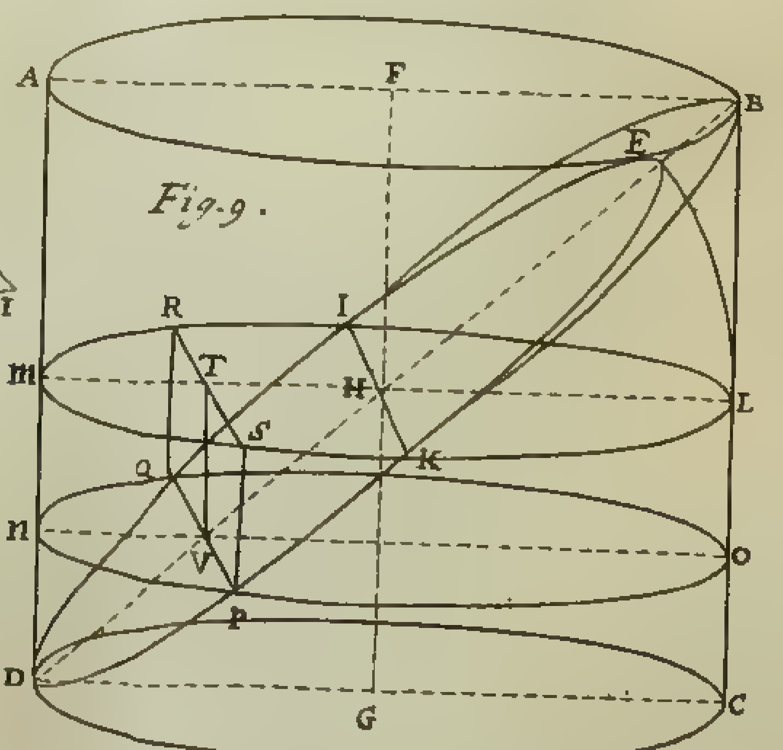

Fig. 9.

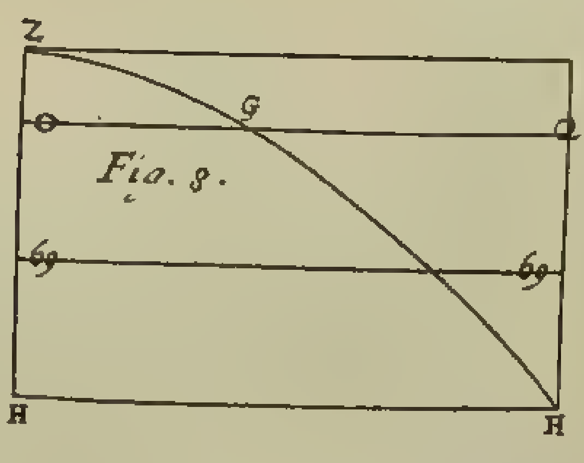

Fig. 8.

PHILOSOPHICAL TRANSACTIONS.

For the Month of September, 1693.

I. THE *Extract of a Letter, giving an Account of a prodigious Storm of* Hail *of an extraordinary bigneſs in* Liſle, *in* May, 1686. II. Obſervatio Eclipſis Solaris *Bononiæ* habita die 12^{a}. *July*; *Anno* 1684. à Cl.V. *D^{no}. Dominico Gulielmino.* III. *Several Obſervations and Experiments on the* Animalcula *in Pepper-Water*, &c. *By Sir* Edm. King, *M.D. and S.R.S.* IV. *The manner of making of* Steel, *and its Temper; with a Gueſs at the way the Ancients uſed to Steel their Picks, for cutting or hewing of* Porphyry. *By* Martin Liſter, *M. D. and S.R.S.* V. *The Deſcription of certain* Shell-fiſh *found in the* Eaſt-Indies, *extracted out of a Letter from Mr.* Witzen *to Dr.*Liſter, *who communicated it to the Publiſher, with ſome Notes of his own thereon.* VI. *A Paper of Mr.* Flowers, *containing ſome unknown ancient* Characters, *with Remarks thereon. By* Francis Aſton, *Eſq; S. R. S.* VII. *A Letter from Mr.* Samuel Dale, *giving a farther Account of ſome Coins found ſome time ſince at* Honedon *in* Suffolk. VIII. *Part of a Letter from Mr.* T. M. *in* Salop, *to Mr.* William Baxter, *concerning the ſtrange Effects from the eating of Dog-Mercury, with* Obſervations *thereon. By* Hans Sloane, *M. D. and S. R. S.* IX. *A Diſcourſe concerning the Proportional Heat of the Sun in all Latitudes, with the Method of collecting the ſame, as it was read before the Royal Society in one of their late Meetings. By* Edm.Halley X. *Accounts of Books.* 1. Diogenes Laertius Græcè & Latinè cum Commentariis integris Doctorum Virorum. *Amſtelodami*, apud *Hen. Wetſtenium*, in 4*to*. 1692. 2. *Conſiderations on a Book Entituled*, The Theory of the

Earth. *Publiſh'd ſome Years ſince by the Learned Dr.* Burnet. *Written by* John Beaumont, jun. *Gent. in 4to.* 1693. *Lond.* 3. Epiſtola ad Regiam Societatem Londinenſem qua de nuperis Terræ-motibus diſſeritur, *&c. in 4to. Lond.* 1693. 4. Traitè des moyens de rendre les *Riviers* navigables, *&c. a Paris, in* 8°. 1693.

I. *The Extract of a Letter from* Liſle *in* Flanders, May 25. *N.S. 1686. giving an Account of an unuſual Storm of Hail which fell there.*

—— THere fell in this City Hail of ſo great a bigneſs, that the leaſt exceeded Pigeons Eggs. Several of them were weighed, and were ſome a quarter of a Pound, others of a Pound Weight and more. One among the reſt was obſerved to contain a dark brown matter in the middle thereof; and being thrown into the Fire, it gave a very great Report. Others were tranſparent, which melted before the Fire immediately. This Storm paſſed over the Cittadel and Town, and left not a whole Glaſs in the Windows on the windward ſide. The Trees were broken, and ſome beat down, and the Partridges and Hares killed in abundance.

II. *Obſervatio Solaris Eclipſis habita Die* 12. *Julii*, 1684. Bononiæ, *à Cl. V. D^{no}.* Dominico Gulielmino.

DEſumebant Solis à Vertice Diſtantias *D. D. Jo. Ludovicus Donellus* & *Nicolaus Ignatius Joanettus*; Phaſibus determinandis tres aderamus, D.D. *Jo. Galeatius Manzius*, *Hercules Vanottus & Ego.* Obſervationes ſcribebat *D. Gregorius Maliſardus*; horas vero in horologio notabat *D. Bartolomæus Ferrarius.*

Horæ horologii automati p. m. Diei 12.	Horæ erutæ ex diſtantiis obſervatis centri ſolis à Vertice.	Diſtantiæ Centri ſolis à Vertice.	Phaſes.
Hor. 3. 20. 00.	—	—	
3. 34.			Eclipſis apparente ſole inter nubes. Quantitas obſcurationis. *dig.* 2. 30.
3. 37. 30.			*dig.* 3.
3. 48. 14.	3. 47. 47.	*gr.* 51. 31.	*dig.* 4. 20. dubia ubiq;
3. 52. 00.			*dig.* 5. optima.
3. 57. 00.	3. 56. 2.	*gr.* 52. 58.	*dig.* 5. 30.
4. 2. 00.	4. 2. 29.	*gr.* 54. 10.	*dig.* 6.
4. 4. 45.	4. 5. 59.	*gr.* 54. 44.	*dig.* 6. 30. optima.
4. 9. 20.	4. 9. 1.	*gr.* 55. 17.	*dig.* 7. exacta.
4. 14. 40.	4. 15. 43.	*gr.* 56. 28.	*dig.* 7.
4. 19. 00.			*dig.* 7. 20. dubia.
4. 27. 44.	4. 28. 42.	*gr.* 58. 39.	*dig.* 7. 20.
4. 32. 35.	4. 34. 20.		*dig.* 7. ſatis exacta.
4. 34. 20.			*dig.* 6. 45.
4. 44. 30.			*dig.* 6. 30.
4. 47. 15.			*dig.* 6. 30.
4. 51. 30.			*dig.* 6. optima.
4. 54. 38.	4. 53. 53.	*gr.* 63. 16.	*dig.* 5. 30. exacta.
4. 58. 2.	4. 57. 38.	*gr.* 63. 56.	*dig.* 5. exacta.
5. 1. 55.	5. 1. 2.	*gr.* 64. 32.	*dig.* 4. 30. ſatis exacta.
5. 4. 40.	5. 5. 28.	*gr.* 65. 19.	*dig.* 4. diligens ubiq;
5. 7. 0.	5. 6. 23.	*gr.* 65. 28.	*dig.* 3. 30. exacta.
5. 10. 30.	5. 9. 9.	*gr.* 65. 58.	*dig.* 3. exacta.
5. 12. 35.	5. 13. 28.	*gr.* 66. 43.	*dig.* 2. 30. ſatis exacta.
5. 16. 15.	5. 16. 14.	*gr.* 67. 13.	*dig.* 2. exacta.
5. 19. 50.	5. 20. 24.	*gr.* 67. 57.	*dig.* 1. 30. exacta.
5. 22. 30.	5. 23. 21.	*gr.* 68. 28.	*dig.* 1. exacta.
5. 25. 0.	5. 25. 14.	*gr.* 68. 48.	*dig.* 0. 30. diligens.
5. 27. 40.	5. 28. 7.	*gr.* 69. 18.	*dig.* 0. accuratiſſima.

Circa obſervationes ab initio Eclipſis uſque ad medium circiter, eas quidem præter unam, aut alteram,omnis erroris expertes eſſe non auſim affirmare ; intercurrentibus enim identidem nubibus Solis ſpecies nonnihilo minor & pallidior reddebatur, unde non omnimoda certitudo promitti poteſt. A medio autem Eclipſis ad finem uſq; cum nullis nubibus Sol impediretur,obſervationes certiores ſunt & diligentius habitæ.

Notabile fuit ; cum quantitas Eclipſis fuerit dig.7. 20. quod non modicam aëris offuſcationem debebat inducere, ut aliàs multoties in conſimilibus defectibus obſervatum eſt ; nihilominus tamen vix ſenſibiliter conſuetum in ſole libero aëris ſtatum mutatum fuiſſe ; unde plurimis ſolem non reſpicientibus orta ſuſpicio, aut ſolem non defeciſſe, aut minimum quidem ; cujus quidem rei non alia mihi videtur aſſignanda cauſa, quàm ingens vis nubium à Sole maxime illuminatarum, quæ non multum ab eo diſtabant ; ab his enim ſolis radius per reflexionem, & refractionem multiplicatus certè intenſior redditus deficientem aliundè ſplendorem potuit compenſare : ſic aliquando videmus præſertim occidente Sole nubes adeo illuminatas eſſe, ut poſt ejus etiam occaſum, vividiſſimam lucem effundant, quinimo etiam umbras non ſemel projiciant.

III. *Several Obſervations and Experiments on the* Animalcula, *in Pepper-Water*, &c. *By Sir* Edm. King, *M. D. and S. R. S.*

S I R,

UPon reading ſome Abſtracts of Mr. *Leeuwenhoek*'s Letters in the late Philoſophical Tranſactions, I called to mind ſome Microſcopical Experiments that I made too, concerning *Animalcula*, which I do not remember, have been publickly taken notice of; therefore in Obedience to your Commands, I have faithfully tranſcrib'd them, ſuch as they are, being certainly true, as to matter of fact.

1. Firſt, having ſteep't Oates in Rain-water, ſome days (perhaps 9. or 10.) and looking upon it with my bare Eye, I ſaw a Subſtance, that ſeem'd to me like that uſually call'd a Mother (on other Liquors) and laying as much of it as a ſmall Pin's head upon the Object Plate of my beſt Microſcope, I could very eaſily and plainly diſcern 7 or 8 ſorts of *Animalcula*, of different ſizes and ſhapes (or more) ſwimming in this Subſtance, which was Liquid enough, for them to perform very nimble and briſk Motions in, which was very pleaſant to obſerve: Their ſhapes and ſizes were after this manner, as near as I could gueſs. *Vide Fig.* 1.

They were all very nimble in their Motions, by computation, ſeveral Thouſand times magnifi'd.

2. The thin Scum upon Pepper-water, that did reſemble Flakes of Salt, upon ſome ſorts of Human Urine, apply'd in the ſame manner to the Object Plate of the Microſcope, was only Cluſters of *Animalcula*, that had Liquid Matter enough to Swim in, and I was in admiration at their Numbers, Motions, Variety and Minuteneſs.

3. In a Decoction of Herbs, that was ſtrain'd, and ſet by for a particular Uſe: In a little of the ſettling of that (as much as a Pin's-head) I ſaw Creatures like little Eeles, about thus long *, and ſeem'd to be as thick, but much ſharper at both ends, with a wriggling Motion, like Eels.

* *Vide* *Fig.* 2.

4. I obſerve theſe ſmall Creatures above-mentioned (if I may ſo call them) reſemble the Nature of Fiſh, in ſeveral reſpects.

Firſt, They'll flock together, and lye cloſe together, as if they were in ſholes, like Carps in a Pond, that has been ſo ſhallow, as I have often ſeen, ſometimes in one place, and ſometimes in another, but when diſturb'd, they are, as to your ſight, all diſpers'd and loſt in a trice; and ſo are theſe little Creatures in their Original Liquor, if you ſhake the Liquor before you look to find them in ſholes, or after: At leaſt I am ſure I did, and could never find any in that parcel of Liquor, till next day, or till they did aſſociate again.

Secondly, They will follow their Liquor, to act in, to the laſt Particle of it, till they have no more to ſwim in, and then will ſeem to ſtruggle for want on't, till their Strength fails them, and then after a minute, or leſs, they will ſeem dead upon the Object Plate, (when the watry Parts are dry'd away).

Thirdly, They will lye as if they were dead, near half an Hour, or more, then put a little Water to them, in half a minute they will begin to move themſelves again, and by degrees, begin to ſwim faintly and feebly at firſt (as Fiſh will do,) and then recovering their ſtrength again, will perform their brisk Motions as vigorous as ever.

Fourthly, Thoſe that are almoſt dead will look flat, as if preſt thin, but when they move, turn themſelves over and over, without any regular Motion; ſo that you might ſee them as thin, as the thinneſt Spangle you ever ſaw, and like it in ſhapes; and they will continue ſo, ſo long as they are faint and ſick; but within about an hours time, they will grow plump and well again, if you add freſh Liquor to them in time.

Theſe *Animalcula* chooſe, for the moſt part, the top of the Liquor; I ſuppoſe for the ſake of the Air.

If you perceive them lye dead upon the Object Plate, as I did, and do not remember to add Water to revive them, within an hour, they will be dead indeed: But you may ſee them in the poſture you left them, many days after, as I did; and ſhewed others the ſame ſight.

Now to give a farther Teſtimony, That they are *Animalcula,* which ſome doubt; I have noted the following Obſervations, for the ſake of thoſe that disbelieve Microſcopical Experiments: But they may as well deny the uſe of Spectacles ſo well known.

If you take a fine Needle, and put the point into Spirit of *Vitriol,* (tho' you can ſee none of the Spirit with your bare Eye upon its Point, when you take it out, yet if you prick the ſame point of that Needle into the middle of that drop no bigger than a ſmall Pin's-head, when ſome Hundreds of theſe *Animalcula* are ſwimming, very nimbly friſking about, you ſhall immediately ſee (as I did) theſe minute Creatures (if I may ſo call them) preſently affected from the Acid Particles, ſo as to ſpread themſelves, and tumble down ſeemingly dead *. * *Vide Fig.* 3.

If you diſſolve Salt, and with the point of the ſame Needle, repeat the Experiment (in the ſame manner) in ſome of the ſame Liquor that contains ſome of the ſame parcel of *Animalcula,* you ſhall ſee the Creatures afore-mentioned, be affected too, ſtop in their Motion, but in another manner quite; not ſpread flat, as thoſe with Spirit of *Vitriol* did, but ſhrink long and round, in Form and Figure of that we call (whole Oatmeal, or) an Excorticated Oat.

And whereas the firſt with the Spirit fell down flat without turning; theſe, as ſoon as affected, turn round and round, when they begin to be ſick, and wobble, as we ſay, before they fall down to the bottom and die; unleſs you quickly recover them with freſh Water, and then you will perceive them get a new Life by degrees.

Tincture of Salt of Tartar put into them in the ſame manner, kills them more immediately; but yet they will be firſt ſo ſick, or ſo affected, call it what you pleaſe, as you may ſee by a ſurpriſing Convulſive Motion, they will grow Faint and Languid apace; as you may ſee them fall to the bottom of the Drop upon your Object Plate dead, but in their own Shape, (which I wondred at) that they were in before you apply'd your Needle, and will neither be flat as with Spirit of *Vitriol*; nor cylindrical, as with common Salt Liquor; but lie dead in the ſame Shape, as before you put in your Needle with the *Salt of Tartar.*

Inks kill them as ſoon as Spirit of *Vitriol*, but makes them ſeem to ſhrink divers ways; I ſuppoſe by the Solution of Copper which is in its Compoſition.

Blood (newly preſt from a Prick purpoſely made in your Finger) kills them almoſt as ſoon as Spirit of *Vitriol*; by reaſon, (I ſuppoſe) of the Salt therein: But it's a fine and ſurpriſing ſight, to obſerve them ſwimming and buſtling, firſt amongſt the Globbules of the Blood juſtling one another, like Fiſh that are ſuddenly depriv'd of Water, and buſtle together amongſt Mud; for ſo they appear'd to me: And I could think of no better a Compariſon then, and I thought my Glaſſes as good as any Bodies, except ſome I have heard of Mr. *Leeuwenhoek*, that I never ſaw.

Vrine kills them too, in a little time, tho' not ſo ſoon.

Sugar diſſolved like Salt kills them alſo, if uſed in the ſame manner, and with that ſome dye flat, and ſome dye round.

Sack will kill them, but not ſo ſpeedily as the other Liquors. If I had had time, I might have ſet down many more Obſervations of this kind, to ſhew the Senſibility of theſe, and ſuch like *Animalcula.*

IV. *The manner of making* Steel, *and its Temper; with a Gueſs at the way the Ancients uſed to Steel their Picks, for the cutting or hewing of* Porphyry. *Communicated by* Martin Liſter, *M. D. and S. R. S.*

IN the Philoſophical Tranſactions, Numb. 93. *p.* 6015. amongſt other Deſiderata's and Queries, are theſe; *To endeavour to retrieve the Art of Hardning and Tempering of Steel, for cutting of* Porphyry, *&c.* We know not which way to rough-hew Stones of that untractable hardneſs.

Thoſe famous and ſtupendious Monuments of Antiquity, the *Ægyptian* Obelisks are of *Porphyry,* and moſt of them curiouſly Carved with a vaſt number of Figures, one way of Writing of the Ancient *Ægyptians*: Theſe Witneſs the Facility that Nation had of graving in *Porphyry*; a Stone which no Tool will now touch, nor nothing leſs affect, than Emery or Diamant Powder.

Mr. *Ray* aſſures us, That all the Obelisks of *Rome*, that are Graven with Hieroglyphicks, are of one and the ſame kind of Stone, *viz.* a Marble of a mingled Colour, Red and White, very hard, and hath not in ſo many Ages ſuffered the leaſt by the Weather.

Some

Something there is certainly loſt in this Age, as to the manner of *Steeling of Tools*: I ſhould be glad, if by any Conjecture of mine, I could help to extricate and retrieve it.

To this Purpoſe, let us firſt ſee what Steel it ſelf is, and how made: and then we ſhall beſt gueſs at the applying of it, in the making of Tools.

As for the moderns, there is great abuſe in this Manufacture, and the Proceſſes now uſed by moſt Nations, are fraudulent, and a poiſoning of Iron, by certain Mineral Salts, rather than a true making of Steel.

The moſt Ancient Account, is that which is given us by *Ariſtotle*, *Meteorologicor. l.* 4. *c.* 6. which yet is very obſcure and imperfect. The Paſſage is this; *Wrought Iron it ſelf may be caſt ſo, as to be made Liquid, and to harden again. And they are wont to make Steel thus: For the* Scoria *of Iron ſubſides, and is purged off by the bottom. And when it hath been often defæcated and made clean, this is Steel. But this they do not often, becauſe of the much waſt, and for that it looſes much Weight in fining. But Iron is ſo much the more excellent, the leſs Excrement it hath.* Thus far *Ariſtotle.*

This Account is a little confuſed, and not well underſtood: It is indeed true, That Iron is ſtill better, the more it is purged. So in our Furnaces in *England*; thoſe Bars which are wrought out of a Loop, taken up out of the Finnery Harth, or ſecond Forage, are much better Iron than thoſe which are made in the Bloomary or firſt Harth, becauſe thoſe are more purged of the Droſs, and accordingly give double Price.

Alſo, it is as true, that even wrought Iron may be melted as oft as you pleaſe.

Again, Iron, as oft as it is melted and purged, looſeth much of its Weight. But after all, Iron of it ſelf, how oft ſoever it is purged and refined, it will never become

Steel; yet of this ſo purged, the beſt Steel doubtleſs may be made.

And this is the moſt favourable Conſtruction that I can make of this Paſſage of *Ariſtotle*.

In the next place, we ſhall give you the beſt account how *true Steel* is made at this Day, waving all fraudulent proceſſes. The manner is this, faithfully deſcribed by *Agricola* (*de re Metallica, lib.* 9.) And to confirm to you the Antiquity of it; this way of making Steel is by *Kircher* ſaid to be now in uſe in the Iſland of *Ilva*, a place famous from all Ages, even from the times of the *Romans*, for that Metal alone, down to our Days.

'Make choice of Iron which is apt to melt, and yet 'hard, and yet which may eaſily be wrought with the 'Hammer: For although Iron, which is made of Vitri'olick Ore, may melt, yet it is ſoft, or fragil, or eager. 'Let a Parcel of ſuch Iron be heated red hot, and let 'it be cut into ſmall Pieces, and then be mixt with that 'ſort of Stone which eaſily melts; then ſet in the Smiths 'Forge or Harth, a Crucible, or Diſh of Crucible Metal, 'a Foot and a half broad, and a Foot deep; fill the Diſh 'with good Charcoal, and compaſs the Diſh about with 'looſe Stones, which may keep in the Mixture of Stone, 'and Pieces of Iron put thereon.

'As ſoon as the Coal is throughly kindled, and the 'Diſh is red hot, give the Blaſt, and let the Workman 'put on, by little and little, all the Mixture of Iron and 'Stone he purpoſes.

'When it is melted, let him thruſt into the middle of 'it 3 or 4, or more Pieces of Iron, and boil them there'in 5 or ſix Hours, with a ſharp Fire; and putting in 'his Rod, ſtir often the melted Iron, that the Pieces of 'Iron may imbibe the ſmaller Particles of the melted Iron, 'which Particles conſume and thin the more groſs Parti'cles of the Iron Pieces; and are, as it were, a Ferment 'to them, and make them tender.

‘ Let the Workman now take one of the Pieces out of ‘ the Fire, and put it under the great Hammer to be ‘ drawn out into Bars, and wrought, and then hot as it is, ‘ forthwith plunge it into cold Water.

‘ Thus Tempered, let him again Work it upon the ‘ Anvil and break it; and looking upon the Fragments, ‘ let him conſider whether it look like Iron in any part ‘ of it, or be wholly condenſed, and turned into Steel.

‘ Then let the Pieces be all wrought into Bars; which ‘ done, give a freſh Blaſt to the Mixture, adding a little ‘ freſh Matter to it, in the room of that which had been ‘ drunk up by the Pieces of Iron; which will refreſh and ‘ ſtrengthen the remainder, and make yet purer, the Pieces ‘ of Iron again put into the Diſh: every which Piece, let ‘ him as ſoon as it is red hot, beat into a Bar upon the Anvil, and caſt it hot as it is into cold Water. And thus Iron is made into Steel; which is much harder and whiter ‘ than Iron.

Being now certain what Steel is, and how it is to be diſtinguiſht and differs from Iron. In the laſt place, we will conſider, if yet any thing can be found in the Ancients, which may hint to us any defect in our Tools, and how that may be remedied.

There is but one place that I know of to this purpoſe, which may give us any ſight in our Enquiry; and that is in *Pliny*, (*lib.* 34. *c.* 14.) where ſpeaking of Iron, he ſays, *Fornacum maxima differentia eſt: in iis equidem* Nucleus *ferri excoquitur ad indurandum aliter, alioque modo ad denſandas incudes malleorumve roſtra.*

From this Paſſage it ſhould ſeem, that the Ancients had one way to make Steel, and another way to harden or temper their Tools, particularly ſuch as Picks and Anvils.

Alſo it is plain, That *Nucleus Ferri* was melted down in both.

Again, the difference was in the Furnaces, that is, in the manner of ordering of the Iron to be made into Steel, or for the ſuperlative hardning of the Heads and Bitts of Tools, and not in the Matter of which they were made; for both was done by excocting them in molten Iron.

I ſuppoſe none will doubt, but by *Nucleus Ferri*, muſt be meant well purged Iron; the ſame which *Ariſtotle* calls εἰργασμένος σίδηρος: For why elſe ſhould he tell us that Wrought Iron it ſelf may be made Liquid, ſo as to harden again; that is, according to our Phraſe, caſt again into Sow-metal, if it was not to explain to us the manner of making of Steel; which yet plainly is his deſign. It remains then, that we ſhew the different manner or uſe of this Liquid Iron; and we have no other light in this matter, but what two different Phraſes afford us, *viz. ad indurandam Aciem*, and that of *ad denſandos incudes malleorumve roſtra.*

The firſt difference then, in my Opinion, is to be underſtood, of making Steel Bairlic; which they did probably after the Precept above delivered; that is, not only boil the Iron in its own *Sow-metal*, or Liquid Iron, but hammer it alſo, and after quench it in cold Water.

And this Opinion thoſe other Words of *Pliny* in the next Chapter favour, *Ferum accenſum igni, niſi duretur ictibus, corrumpitur:* And again, *aquarum ſumma differentia eſt, cui ſubinde candens immergitur.* And this way was ſufficient for Sword-Blades, and Knives, Razours, &c.

The other difference is in the Steeling their Tools: that is, they boiled their Tools in Sow-metal, to ſuch a degree of Hardneſs or Temper, as was requiſite, and did not afterwards hammer them. And this ſeems to be implied in the Phraſe *Denſare*, for indeed, altho' it generally be ſaid, that Iron is purged and refined for the making of Steel, yet according to the laſt and trueſt Proceſs, the matter is plainly otherwiſe; for Iron this way made into Steel, becomes a kind of *Electrum*, and is filled with an exceeding brittle and hard Body of its own Nature; Iron being ſpungy and not cloſe; for which purpoſe therefore, the Word *denſare* is by *Pliny* aptly and elegantly uſed. And this way was uſed when the ſtrongeſt temper and hardneſs was required; as to Picks and Anvils.

There might be divers reaſons given for this laſt uſage; as firſt, that there is far greater eaſe in working Iron, than Steel into any Figure, that being far ſofter and more ductible and looſe.

Again, it is certain, and the Ancients in the paſſage laſt quoted do teſtifie as much, that Iron by ignition is ſpoilt or corrupted, ſo that the oftner it is purged, tho' it were Steel it would the more relent. Whence knowing well, that in making their Tools out of Steel, they could not but conſiderably looſe it and abate of their temper; they therefore firſt ſhaped them, and then gave them a ſtrong Body of Steel and Temper together, and ſo had nothing elſe to do but to finiſh them on the Grindſtone and Hone, to ſet the point or edge.

V. *The Deſcriptions of certain Shells found in the* Eaſt Indies, *Communicated by Mr.* Witzen *to Dr.* Liſter, *and by him to the Publiſher, with ſome Remarks of his own.*

SIR,

I Here ſent you incloſed an Account of certain Shells and their Figures, which I received from Mr. *Witzen*, formerly Ambaſſadour here from the States of *Holland*,

and alſo well known to the Learned World by his excellent Map of *Tartary*.

Tranſlated from the *French*. He Writes thus:

'There are found on the Coaſts of *Malabar* and *Ceylon*, certain Cockles or Shells in *Dutch* called *Kouk-borens*. 'Theſe Shells contain a Fiſh that lives in the bottom of 'the Sea, fixt to the Body of the Shell, and at a certain 'Seaſon of the Year, they caſt their Seed which produ'ces a ſort of *Matrix* of the ſize of the Figure*; this 'long Body which is wrinckled like an *Andouille* or *Sauſ'age* is filled with a great number of round Celles, which 'are ſo many *Matrices*, each producing its little ſhell'fiſh; which quit not their cells till they are grown to 'ſuch a bigneſs and maturity, as their weight breaks them 'off and looſens them from their cells, and ſo from their 'common *Matrix*, which remains faſtned to the bottom 'of the Sea by the great end, the other end moving a'bout freely in the water, which is flexible every way 'like an *Andouille*. This *Matrix* the *Hollanders* call '*Swambalk*. *Vid. Fig.* 4.

'It is obſervable that this *Matrix* has a kind of back'part and Belly, the Back is ſomething like that of a '*Sckelvis* and of a greyiſh colour, the Belly is whiter, 'and is that part which is filled with the cells from one 'end to the other: the Skin which covers it is very like 'that of Stock-fiſh or other dryed Fiſh.

'*Figure* the 5*th*, Is a ſhell found in the River of *Goa*, 'which holds a ſort of Oyſter. It is very ſcarce and 'in the *Indies* as well as here the ſhell powdered is eſteem'ed a good Medicine.

SIR,

SIR,

THis laſt Figure is of an Oiſter-ſhell, the like is to be found in the *Weſt indies*, whether the ſame ſpecies I cannot determine, having never ſeen them intire together to compare them. But Sir, conſidering the hint that is here given us, of its being thought Medicinal at *Goa* where it is found; and alſo how that calcined Shells are the moſt common entertainment all over the *Indies*, chiewing them all day long with the Leaves of a certain hot piperate and ſpicy Plant and a ſort of Nut mixt therewith: we may reaſonably ſuſpect the *Goa* Stone to be made up of them, or ſuch like Ingredients.

Yours, &c.

VI. *A Paper of Mr.* Flowers, *containing ſome unknown Ancient* Characters, *with Remarks thereon by* Francis Aſton *Eſq*; *S. R. S.*

THeſe Characters being Two and Twenty in Number, are all that could be diſtinctly Collected out of the Ancient Sculptures, to be found this day extant at the admired Hills of *Canary*; where there are divers receptacles cut out of the main Rock, by incredible Induſtry and Charge of the Ancient Inhabitants of thoſe Parts ſuppoſed *Moors* or *Negroes* of *Ethiopia* rather than *Gentues*; by reaſon of the large proportion of their uſual Statures, which is at leaſt Eight Foot in heighth, having great Lips, full Eyes, flat Noſe and curled Hair, and is worthy the Obſervation. So far Mr. *Flower Feb.* 3. $167\frac{2}{3}$.

Its probable the intent of this Paper was to compare theſe Characters, being very Ancient with them at *Perſepolis*, the Gentlemen having got together (as appears) ſeveral other Alphabets that had been uſed in the *Eaſtern* parts of the World.

The places here pointed at, are chiefly three, two upon the Iſland *Salſete*, and one upon the Iſland *Pory*, called the *Pagode* of *Olifant* of ſuch a bigneſs that one of them is deſcribed by *Linſchoten* to be equal to a Village of 400 Houſes, to conſiſt of Four Ranges of Building one over another within the Mountain; and to contain no leſs then 300 Rooms or Habitations; adorned throughout with ſtrange frightful Statues, of Idols, of Lyons, Tigers, Elephants, Amazons, and a hundred other things ſo well deſigned,that *Andrea Corſali* in the Year 1515 had a mind to ſend ſome of them to *Julian de Medices* for their Curioſity, who were the Architects is very uncertain. *Balbi* names the *Romans* and *Alexander* the Great, others the Chineſes, Mr. *Flower* the Abeſſins who have ſome few Churches cut in the Rocks; but *Alvarez* who ſaw them twice, ſays the Country affirms they were made by *Ægyptians* or other white Men; but though their beginning be obſcure, their end may more eaſily be declared, for the *Portugueſes* upon the building of *Goa* began to deſtroy them, and have continued to do ſo ever ſince.

VII. *A*

VII. *A Letter from Mr.* Samuel Dale, *giving a further Account of ſome Coins found at* Honedon *in* Suffolk.

S I R,

YOu may Remembor that in one of the Philoſophical Tranſactions of your Honourable Society; Publiſhed in the Year 1687 *viz.* N 189, an Account was given of ſome *Saxon* Coins found at *Honedon* in *Suffolk*, of which I have ſeen divers pieces, tho' I do not remember that the Sexton of the Pariſh who found them, told me of any Pot that they were found in; but only that diging in the Church-yard deeper then ordinary, he chanced to ſtrike with his Pickax juſt among the Mony, and beat it about the Grave, at which being Affrighted, he got out as faſt as he could, and called one of his Neighbours, who coming to the Grave, ſoon perceived what they were, and jumping in began to pick them up; whereupon the Sexton took Courage and jumped into the Grave alſo, and got up into his Hat what he could, Earth and all, which might be between 200 or 300 peices, ſome of which were Green by lying in the Ground, as Sir *P. S.* who communicated that aforeſaid Account; very well obſerved the Novelty of the thing and rarity of the Mony, ſoon procured the Sexton Chapmen enough to purchaſe all his Mony, and among others it was my good hap alſo to procure ſome few; Three of which I think are not publiſhed by that aforeſaid Worthy Gentleman, and therefore herewith ſend you their exact deſigns, hoping they will not be unacceptable to you, which is all at preſent from *Vid. Fig.* 7.

Yours &c.

VIII. *Part of a Letter from Mr.* T. M. *in* Salop, *to Mr.* William Baxter, *concerning the ſtrange effects from the eating* Dog-mercury *with Remarks thereon by* Hans Sloan M. D. *and* S. R. S.

——W. *Matthews*, his Wife and Three Children, have been lately very ill, and like to dye; the occaſion and manner of their Sickneſs was very odd, and therefore I ſhall give you a particular account of both. About Three Weeks ago, the Woman went into the Fields and gathered ſome Herbs, and (having firſt Boyled them) Fryed them with Bacon for her own and her Families Supper: After they had been about Two Howrs in Bed, one of the Children (which is Dumb and about Seven Years Old) fell very Sick, and ſo did the other Two preſently after; which obliged the Man and his Wife to Riſe and take the Children to the Fire, where they Vomited and Purged, and within half an Hour fell faſt aſleep. They took the Children to bed as they were aſleep, and they themſelves went to bed too, and fell faſter aſleep too than ever they had done before. The Man waked the next Morning about Three Hours after his uſual Time, went to his Labour at Mr. *Newports*, and ſo by the ſtrength of his conſtitution carried it off; but he ſays, he thought his Chin had bin all the Day in a Fire, and was forced to keep his Hat full of Water by him all the Day long, and frequently dipt his Chin in it as he was at his Work. The Woman wakened a while after her Husband, and being forced to it, got up to look after her little Family concerns; but ſhe was very Sick and has continued ſo till within theſe few Days, ſince which ſhe is very well recovered. One of their Children ſlept from that Night (which was Thurſday Three Weeks) till Monday Evening following; and then (having juſt only opened her Eyes and made Two Sprunts, without ſpeaking one word) dyed imediately while ſhe was aſleep; endeavours were uſed to awaken her, but in vain. The other Two Children ſlept about Twenty Four Hours, and upon their wakening fell a Vomiting and Purging again, which I think ſaved their Lives. By Mr. *Newports* and my Direction, they ſent ſome of the ſame Herb to the Doctors and Apothecaries in *Salop*, who generally ſay 'tis *Dog-mercury*, but ſome ſay 'tis a ſort of Night ſhade: whatever it be, 'tis certainly Poiſonous, and 'tis obſerved that the Cattle never browſe it. *Matthews* told me he never eat ſo pleaſant an Herb in his Life; and his Wife ſays that her old Maſter, *viz.* Mr. *Moxon* did frequently eat of it; but I gueſs it to be a miſtake. I know your profound Judgment and Learning in theſe matters, and have therefore given you this large Account. I am no herbariſt, but this I obſerved of the Herb; 'tis branched and ſeeded ſomething like *Spinage* or *Mercury*, but leaved rather like *Lakeweed.* The leaves are dented too.

Yours,

T. M.

SIR,

THE encloſed Letter was ſent laſt *April*, to Mr. *William Baxter*, who ſoon after did me the Favour to ſhew it me; I found the operations of the Plant therein mentioned to be extraordinary, and the Circumſtances related very particularly, and that the account was the more Surprizing if it ſhould be *Dog-mercury*; which by all Writers I have peruſed, is reckoned innocent and to have the ſame Vertue with the ordinary Mercury uſed every day by Phiſitians. On theſe Conſiderations I begg'd the Favour of Mr. *Baxter*, that he would pleaſe to write to the Gentleman who ſent the Account, for a Dried Sample or Specimen of the Herb; which he did, and it proves to be the ſame they thought it was, the Stalks, Leaves and Spikes agreeing exactly in every thing with thoſe of *Dog-Mercury*. It is deſcrib'd and figur'd in ſeveral Authors. Mr. *Ray* in his Hiſtory of Plants calls it *Mercurialis Perennis repens* Cynocrambe *dicta*, p.163. *Gerard* calls it *Cynocrambe*, p. 333. *Parkinſon*, *Mercurialis Sylveſtris Cynocrambe dicta vulgaris*, p. 295. *Theatr. Botan. Johan. Bauhine* in his Second Tome, *Lib.* 23. *Cynocrambe mas & fœmina ſive Mercurialis repens*, p.979. And *Caſpar Bauhine* in his *Pinax*, p.122. *Mercurialis Montana teſticulata & ſpicata:* In which Books the other Names given it by other *Herbaliſts* may be found, whither I refer you for a further Account of it. Whether the Quantity or Quality of this were the Cauſe of the Effects I know not, but think that every Body will do well to be cautious and wary in the uſe of it in ſuch Quantities, after ſuch a Warning.

Yours, &c.

IX. *A Diſcourſe concerning the Proportional Heat of the Sun in all Latitudes, with the Method of collecting the ſame, as it was read before the Royal Society in one of their late Meetings.*

By E. Halley.

THere having lately ariſen ſome Diſcourſe about that part of the Heat of Weather, ſimply produced by the Action of the Sun; and I having affirmed, that if that were conſidered, as the only Cauſe of the Heat of the Weather, I ſaw no reaſon, but that under the Pole the ſolſtitial Day ought to be as hot as it is under the Equinoctial, when the Sun comes vertical, or over the Zenith: for this reaſon, that for all the 24 Hours of that Day under the Pole, the Sun's Beams are inclined to the Horizon, with an Angle of 23 ½ degrees; and under the Equinoctial, though he come vertical, yet he ſhines no more then 12 Hours, and is again 12 Hours abſent, and that for 3 Hours 8 Min. of that 12 Hours he is not ſo much elevated as under the Pole; ſo that he is not 9 of the whole 24 higher than 'tis there, and is 15 Hours lower. Now the ſimple Action of the Sun is, as all other Impulſes or Stroaks, more or leſs forceable, according to the *Sinus* of the Angle of Incidence, or to the Perpendicular let fall on the Plain, whence the Vertical Ray (being that of the greateſt Heat) being put *Radius*, the force of the Sun on the Horizontal Surface of the Earth will be to that, as the *Sinus* of the Sun's Altitude at any other time. This being allowed for true, it will then follow, that the time of the continuance of the Sun's ſhining being taken for a *Baſis*, and the *Sines* of the Sun's Altitudes erected thereon as

Perpendiculars, and a Curve drawn through the Extremities of thoſe Perpendiculars, the *Area* comprehended ſhall be proportionate to the Collection of the Heat of all the Beams of the Sun in that ſpace of time. Hence it will follow, that under the Pole the Collection of all the Heat of a tropical Day, is proportionate to a Rectangle of the *Sine* of $23\frac{1}{2}$ *gr.* into 24 Hours or the Circumference of a Circle; that is, the *Sine* of $23\frac{1}{2}$ *gr.* being nearly 4 tenths of Radius; as $\frac{8}{10}$ into 12 Hours. Or the Polar Heat is equal to that of the Sun continuing 12 Hours above the Horizon, at 53 *gr.* height, than which the Sun is not 5 Hours more elevated under the Equinoctial.

But that this matter may be the better underſtood, I have exemplied it by a Scheme (*Fig.* 8.) wherein the *Area ZG HH,* is equal to the *Area* of all the *Sines* of the Sun's Altitide under the Equinoctial, erected on the reſpective Hours from Sun-riſe to the Zenith; and the *Area* ♋ *H H* ♋ is in the ſame proportion to the Heat for the ſame 6 Hours under the Pole on the Tropical Day; and ⊙ *H HQ,* is proportional to the collected Heat of 12 Hours, or half a Day under the Pole, which ſpace ⊙ *H HQ* is viſibly greater than the other *Area HZGH,* by as much as the *Area HGQ* is greater than the *Area ZG* ⊙; which, that it it ſo, is viſible to ſight, by a great exceſs; and ſo much in proportion does the Heat of the 24 Hours Sun ſhine under the Pole, exceed that of the twelve Hours under the Equinoctial: whence *Cæteris paribus,* it is reaſonable to conclude, that were the Sun perpetually under the Tropick, the Pole would be at leaſt as warm, as it is now under the Line it ſelf.

But whereas the Nature of Heat is to remain in the Subject, after the Cauſe that heated is removed, and particularly in the Air; under the Equinoctial the twelve Hours abſence of the Sun does very little ſtill the Motion impreſs'd by the paſt Action of his Rays wherein Heat conſiſts, before he ariſe again: But under the Pole the long abſence of the ⊙ for 6 Months, wherein the extremity of Cold does obtain, has ſo chill'd the Air, that it is as it were froſen, and cannot, before the Sun has got far towards it, be any way ſenſible of his preſence, his Beams being obſtructed by thick Clouds, and perpetual Foggs and Miſts, and by that *Atmoſphere of Cold*, as the late Honourable Mr. *Boyle* was pleaſed to term it, proceeding from the everlaſting Ice, which in immenſe Quantities does chill the neighbouring Air, and which the too ſoon retreat of the Sun leaves unthawed, to encreaſe again, during the long Winter that follows this ſhort Interval of Summer. But the differing Degrees of Heat and Cold in differing Places, depend in a great meaſure upon the Accidents of the Neighbourhood of high Mountains, whoſe height exceedingly chills the Air brought by the Winds over them; and of the nature of the Soyle, which variouſly retains the Heat, particularly the Sandy, which in *Africa*, *Arabia*, and generally where ſuch Sandy Deſarts are found, do make the Heat of the Summer incredible to thoſe that have not felt it.

In proſecution of this firſt Thought, I have ſolved the Problem generally, *viz.* to give the proportional degree of Heat or the ſum of all the *Sines* of the Sun's Altitude, while he is above the Horizon in any oblique Sphere, by reducing it to the finding of the Curve Surface of a Cylindrick Hoof, or of a given part thereof.

Now this Problem is not of that difficulty as appears at firſt ſight, for in *Fig.* 9. let the Cylinder ABCD be cut obliquely with the Ellipſe BKDI, and by the centre thereof H, deſcribe the Circle IKLM; I ſay, the Curve Surface IKLB is equal to the Rectangle of IK and BL, or of HK and 2 BL or BC: And if there be ſuppoſed another Circle, as NQPO, cutting the ſaid Ellipſe in the points P, Q; draw PS, QR, parallel to the Cylinders Axe, till they meet with the aforeſaid Circle IKLM in the points R, S, and draw the Lines RTS, QVP biſected in T and V. I ſay again, that the Curve Surface RMSQDP is equal to the Rectangle of BL or MD and RS, or of 2 BL or AD and ST or VP; and the Curve Surface QNPD is equal to RS $\times$ MD — the Arch RMS $\times$ SP, or the Arch MS $\times$ 2 SP: or it is equal to the Surface RMSQDP, ſubtracting the Surface RMSQNP. So likewiſe the Curve Surface QBPO is equal to the ſum of the Surface RMSQDP or RS $\times$ MD, and of the Surface RESQOP or the Arch LS $\times$ 2 SP.

This is moſt eaſily demonſtrated from the conſideration, That the Cylindrick Surface IKLB is to the inſcribed Spherical Surface IKLE, either in the whole or in its Analogous Parts, as the tangent BL is to the Arch EL, and from the Demonſtrations of *Archimedes de Sphæra & Cylindro, Lib.* I. *prop.* XXX. and XXXVII. XXXIIX. which I ſhall not repeat here, but leave the Reader the pleaſure of examining it himſelf; nor will it be amiſs to conſult Dr. *Barrows*'s Learned Lectures on that Book, Publiſhed at *London, An.* 1684, *viz. Probl.* IX. and the Corollaries thereof.

Now to reduce our Caſe of the Sum of all the *Sines* of the Suns Altitude in a given Declination and Latitude to the aforeſaid Problem, let us conſider *Fig.* 10. which is the *Analemma* projected on the Plain of the *Meridian*, Z the Zenith, P the Pole, HH the Horizon, æ æ the Equinoctial, ♋ ♋, ♑ ♑ the two Tropicks, ♋I the *Sine* of the Meridian Altitude in ♋; and equal thereto, but perpendicular to the Tropick, erect ♋1, and draw the Line T 1 interſecting the Horizon in T, and the hour Circle of 6, in the Point 4, and 6 4 ſhall be equal to 6R, or to the *Sine* of the Altitude at 6: and the like for any other Point in the Tropick, erecting a Perpendicular thereat, terminated by the Line T 1: Through the Point 4 draw the Line 4 5 7 parallel to the Tropick, and repreſenting a Circle equal thereto ; then ſhall the Tropick ♋ ♋ in *Fig.* 10. anſwer to the Circle NOPQ, in *Fig.* 9. the Circle 4 5 7 ſhall anſwer the Circle IKLM, T 4 1 ſhall anſwer to the Elliptick Segment QIBKP, 6 R or 6 4 ſhall anſwer to SP, and 5 1 to BL, and the Arch ♋ T, to the Arch LS, being the ſemidiurnal Arch in that Latitude and Declination ; the *Sine* whereof, though not expreſſible in *Fig.* 10. muſt be conceived as Analogous to the Line TS or UP in *Fig.* 9.

The Relation between theſe two Figures being well underſtood, it will follow from what precedes, That, *the Sum of the* Sines *of the Meridian Altitudes of the Sun in the two Tropicks, (and the like for any two oppoſite Parallels) being multiplied by the* Sine *of the ſemidiurnal Arch, will give an* Area *analogous to the Curve Surface R M S Q D P ; and thereto adding in Summer, or ſubſtracting in Winter, the product of the length of the ſemidiurnal Arch, (taken according to* Van Ceulen's *Numbers) into the difference of the above-ſaid* Sines *of Meridian Altitude : the Sum in one caſe, and difference in the other ſhall be as the Aggregate of all the* Sines *of the Sun's Altitude, during his appearance above the Horizon ; and conſequently of all his Heat or Action on the Plain of the Horizon in the propoſed Day.* And this may alſo be extended to the parts of the ſame Day ; for if the aforeſaid Sum of the *Sines* of the Meridian Altitudes, be multiplied by half the Sum of the *Sines* of the Sun's horary diſtance from Noon, when the Times are before and after Noon ; or by half their difference, when both are on the ſame ſide of the Meridian ; and thereto in Summer, or therefrom in Winter, be added or ſubſtracted the product of half the Arch anſwerable to the propoſed Interval of Time, into the difference of the *Sines* of Meridian Altitudes, the ſum in one caſe, and difference in the other, ſhall be proportional to all the Action of the Sun during that ſpace of time.

I foreſee it will be objected, that I take the *Radius* of my Circle on which I erect my Perpendiculars always the ſame, whereas the Parallels of Declination are unequal; but to this I anſwer, that our ſaid circular Baſes ought not to be Analogous to the Parallels, but to the Times of Revolution, which are equal in all of them.

It may perhaps be uſeful to give an Example of the Computation of this Rule, which may ſeem difficult to ſome. Let the Solſtitial Heat, in ♋ and ♑ be required at *London*, *Lat*. 51°. 3'2.

38° - 2'8	*Co - Lat.*		*Diff. Aſcen.* 33° - 1'1.
23 - 30	*Decl.* ☉		*Arc.Semidi.æſtiv.* 123 - 11.
61 - 58	*Sinus* =	,882674	*Arc.Semidiur. hyb.* 56 - 49. *Sin.*,638923
14 - 58	*Sinus* =	,258257	*Arc.æſtiv.menſura* 2,149955.
	Summa	1,140931	*Arc. hyber menſura* 991683.
	Diff.	,624417	

Then 1,140931 in ,836923 + ,624417 in 2,149955 = 2,29734
And 1,140931 in ,836929 — ,624417 in ,991638 = 33895

So that 2,29734 will be as the Tropical Summers days Heat, and 0,33895 as the Action of the Sun in the Day of the Winter Solſtice.

After this manner I computed the following Table for every tenth Degree of Latitude, to the Equinoctial and Tropical Sun, by which an Eſtimate may be made of the intermediate Degrees.

Lat.	Sun in ♈ ♎	Sun in ♋	Sun in ♑
0	20000	18341	18341
10	19696	20290	15834
20	18794	21737	13166
30	17321	22651	10124
40	15321	23048	6944
50	12855	22991	3798
60	10000	22773	1075
70	6840	23543	000
80	3473	24673	000
90	0000	25055	000

Thoſe that deſire more of the Nature of this Problem, as to the Geometry thereof, would do well to compare the XIII *Prop. Cap.* V. of the Learned Treatiſe, *De Calculo Centri Gravitatis*, by the Reverend Dr. *Wallis*, Publiſhed *Anno.* 1670.

From this Rule there follow ſeveral Corollaries worth Note: As I. that the Equinoctial Heat when the Sun comes Vertical, is as twice the Square of *Radius*, which may be propoſed as a Standard to compare with in all other Caſes. II. That under the Equinoctial, the Heat is as the *Sine* of the Sun's Declination. III. That in the Frigid Zones when the Sun ſets not, the Heat is as the Circumference of a Circle into the *Sine* of the Altitude at 6. And conſequently that in the ſame Latitude theſe Aggregates of Warmth, are as the *Sines* of the Sun's Declinations; and in the ſame Declination of *Sol*, they are as the *Sines* of the Latitudes, and generally they are as the *Sines* of the Latitudes into the *Sines* of Declination.

IV. That the Equinoctial Days Heat is every where as the Co-ſine of the Latitude. V. In all places where the Sun ſets, the difference between the Summer and Winter Heats, when the Declinations are contrary, is equal to a Circle into the *Sine* of the Altitude at 6 in the Summer Parallel, and conſequently thoſe differences are as the *Sines* of Latitude into or multiplied by the *Sines* of Declination. VI. From the Table I have added, it appears that the Tropical Sun under the Equinoctial has of all others the leaſt Force. Under the Pole it is greater than any other days Heat whatſoever, being to that of the Equinoctial as 5 to 4.

From the Table and theſe Coralleries may a general *Idea* be conceived of the Sum of all the Actions of the Sun in the whole Year, and that part of Heat that ariſes ſimply from the Preſence of the Sun be brought to a Geometrical Certainty: And if the like could be perform'd for Cold; which is ſomething elſe than the bare Abſence of the Sun, as appears by many Inſtances, we might hope to bring what relates to this part of *Meteorology* to a perfect Theory.

X. An Account of BOOKS.

1. *Diogenes Laertius Græce & Latine, cum Commentariis integris Doctorum Virorum Amſtelodami. Typis* Henrici Wetſtenii, *Anno 1692. Proſtant* Londini *apud* S. Smith *&* B. Walford *ad Inſignia Principis in Cœmeterio* D. Pauli.

THE Ten Books of *Diogenes Laertius*, containing the *Lives*, *Sayings* and *Opinions* of the moſt ancient and eminent Philoſophers of *Greece*, have been Printed more than Twenty times, (a good Teſtimony of their Acceptance with the Learned) as appeareth by a Catalogue of the ſeveral Editions, which we find ſet here in the Entry of the former Volume.

All theſe Editions gradually ſurpaſſed each other by ſome new Accompliſhments; yet all are very far ſhort of that Perfection which this hath attained.

Its evident that Mr. *H. Wetſten* before he adventured on this famous Piece, firſt took the Advice of his Learned Friends of ſeveral Nations; from whom he underſtood what further Improvements *Diogenes* might yet receive. After this he (and who could do it better?) caſt the Work into the moſt uſeful Form and Model. Laſtly, He ſpared no Coſt in providing the moſt excellent paper, Types, Sculpts, and Heads of the Philoſophers which could be found amongſt the curious Antiquaries.

And when we ſpeak of the Elegancy of the Types and Letters uſed in this Impreſſion, we cannot but obſerve to the Reader, that Mr. *Wetſten*, by Advice of that moſt Learned Man Mr. *Mark Meibomius*, hath in this Edition (and ſome other Greek Books) thrown away out of the Alphabet all thoſe knotty and perplexing Abbreviations, commonly called by Printers *Ligatures*. Theſe *Ligatures* have been a long time Thorns in the Eyes of all that firſt learn Greek. It may be hoped that all Founders of Greek Letters will for the future wholly omit, and baniſh theſe troubleſom and uſeleſs *Ligatures*.

The Greek Text of *Diogenes Laertius* was thought ſtill, even after that Edition at *London*, 1663. very corrupt and unintelligible. Therefore Mr. *Wetſten* made a Journey into *England*, to ſee what Helps might here be had, to mend the Text. Two Copies in Greek of *Diogenes* were found; one in *Trinity* Colledge in *Cambridge*, the other in the *Arundelian* Library, now in the Poſſeſſion of the Royal Society. Out of both theſe the Publiſher, Mr. *Wetſten*, obtained the *Variantes Lectiones* from his Friend Dr. *Gale*, who had entred them upon his *Laertius*, which he put into Mr. *Wetſten*'s hand.

Now whereas the famous Mr. *Ægidius Menagius* in the *London* Edition of *Diogenes*, was thought to have left nothing untoucht in his Polite Notes, which might illuſtrate his Author; yet here, in this Edition, he hath added ſo wonderful Collections, that he hath now outdone not only *Iſaac Caſaubone*, *Aldobrandinus* and others, but even himſelf alſo.

To him in the ſame Undertaking hath ſucceeded Mr. *Kuhnius*, who very happily hath cleared many places which ſeemed ſtill dark and leſs intelligible.

But to omit all others, we here find the moſt accurate Critick in the Greek and Latin Languages, *M. Meibomius*, far engaged: He undertook the reviſing of the Copy, the Correcting the Preſs, the directing and ſteering the

whole

whole Work; and alſo beſides his commenting on a good part of it, he hath mended and ſupplied the Defects of the Latin Verſion, which was indeed hitherto very lame and inſufficient.

Here are in the end ſubjoyned Four very neceſſary Indexes: For all theſe we are beholden to the Learned Mr. *John Clerk*. The Firſt, to mention no more, ſo far exceedeth that in the late Edition, which contained the Names of Authors alledged by *Laertius*, that it may well be judged to be totally a new one.

In a word, this Age hath not ſeen any Work performed with ſo great Fidelity, Accuracy, Elegancy and Perfection in all Points, as we ſee meet here in this Edition, Mr. *Wetſten* hath very highly, at his own proper Charge, obliged the Publick; may he find encouragement for other his worthy Undertakings in future.

2. *Conſiderations on a Book Entituled*, The Theory of the Earth: *Publiſh'd ſome Years ſince by the Learned Dr.* Burnet. *Written by* John Beaumont, jun. *Gent.*

THO' ſeveral Perſons before had printed ſome Reflections on this *Theory*, the Author of theſe *Conſiderations*; arguing generally in a way differing from them, thought it might not be a thing ungrateful to the Learned, if he publiſh'd what his own Thoughts might be towards the clearing of the abſtruſe matters there treated. He proceeds upon each Chapter, as the Author of the *Theory* has writ them, in his Engliſh Copy, firſt briefly ſtating the Contents, and then offering what he has to ſay upon them. The *Theory* is divided into Two Parts. The Firſt treats of the *Deluge and Diſſolution of the Earth.* The Second of the *Primæval Earth and Paradiſe.*

As to the firſt part of the *Theory*, the Author of theſe *Conſiderations* on it, firſt ſets forth, in oppoſition to it, what he finds the Grounds and Reaſons of the Ancients generally were, for admitting *Deluges* and *Conflagrations*, and what their Learning was in General. Next, Whereas a *Chaos* is repreſented in the *Theory* (as the ground on which its Author propoſes to build it) whence the World is ſaid to have riſen in time: He ſhews that there is no material Reaſon, why a *Chaos* ſhould be admitted, and that, as far as Humane Underſtanding can reach, the World may have been in a perfect ſtate from Eternity, according to the Opinion of *Ariſtotle*, its Riſe in time being meerly a Point of *Faith*. And admitting a *Chaos*, and a gradual Formation of the World from it, he conceives he has repreſented a more natural Explication of the *Modus*, than that which is propos'd in the *Theory*. And again, admitting the Original Formation of the World, as the *Theory* has repreſented it, *viz* By a firſt Sediment of the *Chaos*, and an Orb of Waters or an Abyſs Orb over that, and an Orb of Earth over both; which made the Primigenial or Antidiluvian Earth, he thinks he has ſhewn it impoſſible, that *Noah's Deluge* and the Formation of the preſent Earth ſhould have been thence caus'd, and this both according to the Proportions of the Orbs of Earth and Waters, repreſented in the *Schemes* of the *Theory*, and according to other Proportions which ſeem to be there intimated; and he conceives no other Proportions whatſoever aſſignable to ſuch Orbs, for producing the ſaid Effects, but he ſhall be able to ſhew the ſame Impoſſibility.

In the next place he argues againſt the aſſigning of any Natural Cauſes for the *Deluge*, which is undertaken in the *Theory* : And whereas its there ſet forth, that the Earth before the *Deluge* was all ſmooth and even, without *Mountains* and a *Sea* ; he ſhews by many natural Reaſons the neceſſity of both from the beginning of the World : And for a Concluſion to this part of the *Theory*, it being there ſet forth, that the firſt Order of things is regular and ſimple ; and that the Deformity of the preſent Earth, as it appears all broken ; and its Incommodiouſneſs ſhew, that the preſent ſtate of it was not Original, nor diſpos'd according to the Laws of Gravity. He replies to this, that Common Gravitation rules not all in the Diſtribution of the parts of the World ; as tho' all the heavieſt parts were to be lowermoſt,and the lighteſt uppermoſt, no more than in the Diſtribution of the parts of Animals, in whom many times, in order to certain uſes, the heavieſt parts are plac'd uppermoſt, and lighter lowermoſt ; and he thinks it eaſie to ſhew analogous uſes in the parts of the Earth, if their Site be ſometimes in the like Order.

As to the Second Part of the *Theory*, concerning the *Primæval Earth* and *Paradiſe*, its there ſet forth, That the Ancients having repreſented in the *Golden Age*, or Paradiſiacal Times, a perpetual Spring, a great Longevity of Animals, and the production of them out of the Earth, and the great Fertility of the Soil in all other things ; the Earth, in the Antidiluvian times, muſt have had a right Situation and Poſture to the Sun,which muſt then have conſtantly mov'd in the *Equinox*, for making good theſe things ; and that upon the Earths Diſruption at the *Deluge*, it loſt its equal Poyſe, and ſo its right or *parallel* Situation, which it had before to the Sun, was chang'd into an Oblique, in which Poſture it has ſtood ever ſince ; and upon this Change, the Change of the Form of the Year hapned, it bringing in the inequality of Seaſons.

Now the Author of the *Conſiderations* having made good, as he conceives, in the firſt part of them, That the Earth could not be otherwiſe ballanc'd before the *Deluge* than ſince, here farther ſhews the impoſſibility of the Earths changing it's Poſture, through the Cauſes aſſigned in the *Theory*; and ſubjoyns many Reaſons why the Earth muſt have always had the ſame Poſture to the Sun it has now; and repreſents many Abſurdities which muſt follow, if it had that Poſture to the Sun in the Antediluvian Times which is contended for in the *Theory*. And as for the Antediluvian Longevity's being aſcrib'd to the ſaid Poſture of the Earth to the Sun, he ſhews that the varieties of Species and Conſtitutions in Animals being conſidered, the Diverſity of Seaſons is more commodious for their orderly Succeſſion in Life, and aſſigns other Cauſes, more probable, as he conceives, for the ſaid Longevity. Next, the *Theory* ſets forth the Source and Origine of the Waters in the Primæval Earth, the Courſe the Rivers then had, and their iſſue; the ſtate of the Air in the Antediluvian times, and the Origine of the Rainbow; againſt all which many things are objected in the *Conſiderations*. And whereas the *Theory* repreſents *Paradiſe* as plac'd in the other Hemiſphere by the ancient Gentiles and Chriſtian Fathers, the *Conſiderations* ſet forth, That as for the Ancient Gentiles, they meant *Paradiſe* only Intellectual, as the Allegorical Fathers did; and that tho' moſt of the Chriſtian Fathers held a Topical *Paradiſe*, yet there is no ground for us to conclude, that they held it to be in the other Hemiſphere, but rather in this we inhabit.

In the next place the *Theory* gives an Explanation of the Ancient's *Chaos*; repreſents the *Torrid Zone*, uninhabitable before the *Deluge*, and the Changes of the *Poles* of the World at the *Deluge*; explains the Doctrine of the

Ancients concerning the *Mundane Egg*, and how *America* was firſt Peopled: All which Points are oppos'd in the *Conſiderations.* As for the two laſt Chapters of the *Theory*, which treat concerning the Author of Nature, and Natural Providence; the Author of the *Conſiderations* owns them to be well and ſoundly reaſon'd; and for a Concluſion, gives his own Opinion, what he conceives may be ſaid concerning the *Creation*, *Deluge*, *Conflagration*, *New Heavens* and *New Earth*, *Paradiſe*, &c. according to the Sence of the Ancients. And whereas the Motive which induc'd the Author of the *Theory* to write it, was (as he ſays) to juſtifie the Doctrines of the Univerſal *Deluge* and of *Paradiſe*, by a new Light of Nature and Philoſophy; the Author of the *Conſiderations* thinks, that when things are repreſented in the *Scriptures*, as grounded on a particular Providence, as he conceives the *Deluge* and *Paradiſe* are, we ought not to endeavour to aſſign Natural Cauſes for them, which do but deſtroy the Miracle by leſſening it; there being no Divine Law but muſt ſet forth God as a moſt free Agent, and often acting beſide and contrary to the tendency and common courſe of any Natural Cauſes whatſoever.

3. *Epiſtola ad Regiam Societatem Londinenſem, qua de nuperis terræ-motibus diſſeritur, & veræ eorum Cauſæ eruuntur.* Lond. *in* 4*to.* 1693.

THE Author of this little Tract, who is pleaſed to conceal his Name, complains in the firſt place of the little Regard many Learned Men have for Aſtrology, who account it trifling, falſe and impious; from which Imputations he by no means excuſes that part which relates to Nativities and Humane Actions, but affirms it unjuſt ſo to judge of that part which ſearches after the general Cauſes of the great Alterations of the Air, Epidemical Diſtempers, Comets, Earthquakes, and the like univerſal Effects of Nature. Theſe he endeavours to ſhew proceed from the Influences of the Stars, from their conſtant Concomitancy to ſuch returning Poſitions of the Heavens. Proceeding to the late Earthquakes, he ſhews them to be cauſed by the Stars, according to the Principles of the Aſtro-meteorological Art, publiſh'd by Dr. *Goad*, who foretold ſeveral great Alterations, as, Earthquakes, *&c.* to happen in the Years 92, 93, 94, 95. and gives a Scheme of the Heavens, *Dec.* 28. 92. *St. V. hor.* 10. *noct.* the time when *Ætna* began to roar, *viz.*

♊ 12. ♃ ℞.

♐ 7 ♀. 17 ♄. ♑ 5 ♂ *tard.* 18 ☉ ♒ 5 ☽. 6 ☿ *tard.*

The next day the Earthquake began. He makes ſome Obſervations on this Figure of the Heavens, and the Earthquake that followed it, the greateſt Shake being at the $\frac{1}{11}$ of *Jan.* 93.

By the ſame Art he attempts to give a reaſon of the Earthquake in *Jamaica*, *Jun.* $\frac{7}{17}$, 92. *ſemihora ante merid.* conſulting the ſame Treatiſes of Dr. *Goad*, and affirms the ſame may be obſerved of the Earthquake that happened at *London*, and other parts, *Sept.* 8. *St. V.* 92. a little after 2 p. m.

He concludes theſe Warnings are given the World to forſake their Wickedneſs, and eſpecially Idolatry, which will at laſt bring on the final Conflagration.

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4. *Traité des Moyens de rendre les Rivieres navigables, &c. a Paris, 1693. in 8vo.*

THE Author of this Treatiſe tells us in the Preface, that the Methods and Machines he propoſes are not meer Imaginations, but are already put in practice chiefly by the *Hollanders*, who have the moſt cultivated this matter. Coming to the ſubject in hand, he ſuppoſes firſt, that all Impediments to its being Navigable, are of two ſorts, either in the Channel it ſelf, or out of it; the latter are cauſed either from the badneſs of the Banks, on which Men and Horſes cannot eaſily paſs to draw up the Veſſels againſt the Stream, ſuch as Trees, croſs Rivulets, *&c.* The other Hindrances in the Channel are from Rocks, inequality of the bottom, Falls, Mills, dividing of the Stream, Rapidity, overflowing and breaking down of the Banks, Banks of Sand, *&c.* all which he reduces chiefly to Four; too great a breadth in ſome places and by that reaſon Shallowneſs, eſpecially in the Summer; Water-falls or Caſcades; Rocks to be met with in the bottom; or laſtly, Mills. For each of theſe he propoſes ſome Remedies; and for ſuch as ariſe from the Banks, they are eaſie to be overcome by a little Labour : And here he ſhews the Method of drawing a Veſſel up the Stream, where the winding of the Stream makes an acute Angle, ſo that Veſſels are apt to ſtrike againſt it, and gives the Figure of an Engine for that purpoſe. Proceeding to the other Impediments from the Channel : As to the firſt, He ſhews the ways of narrowing it by Piles drove down and inter-wound with Branches of Trees, the middle fill'd up with Faſcines, and on thoſe great Stones : Theſe Works are to be made almoſt even with the Surface of the Water, that extraordinary Floods may go over them, rather than bear too hard upon them. He gives ſeveral Directions for this matter, with the ſhape of the Piles, and the ways of driving them above and under Water, annexing the Figures of them, and the Engines for that purpoſe. The means of remedying the ſecond Inconvenience, cauſed by the inequality of the bottom, or by Caſcades, are firſt by Bridges with Rolers, over which the Veſſel, which ought to be flat bottom'd, is drawn. Secondly, by Sluces, eſpecially for Water-falls : Of theſe he ſhews the make and uſe. For the third Obſtacle, cauſed by Rocks, he ſhews the Method of working dry in the bottom of the Water, ſo to break and carry them away. Then he ſhews ſeveral ways of preſerving the Banks of Rivers, by building Wings or Cribs to break the force of the Water ; by Piles drove along the Shore ; by making a new Channel, *&c.* He ſhews ſome ways of cleanſing and evening the bottoms of Rivers, and proceeds to treat of Floods and Inundations, with their Cauſes, Effects and Remedies. He concludes his Treatiſe with the ways of cleanſing and opening Ports and Channels, giving the Schemes of ſeveral Engines to this end.

At the end of the Treatiſe he ſhews the means of weighing up ſunken Veſſels, blowing up the Decks under Water, and taking out the Goods by means of the Diving Bell, *&c.*

ERRATA.

NUmb. 200. p. 748. l.14. r. *at.* p.749. l.12. r.*atro.* p.751. l.20. r. *Plectronites.* l. 28. r. *lapidis.* l. 30. r. *titulis.* Numb. 201. In the engraved Plate of the Characters, N° 2. l. 2. r. ΒΑCΙΛΕΩΝ. p.784. l.12. r. *conſiderable.* p. 791. l.15. r. *at Col.* Coles.

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Printed for *S. Smith* and *B. Walford*, Printers to the *Royal Society*, at the *Princes Arms* in St. *Paul's* Church-yard, 1693.

BRITISH MUSEUM NATURAL HISTORY.

Philosophical Transactions. N°.204.

Fig:1

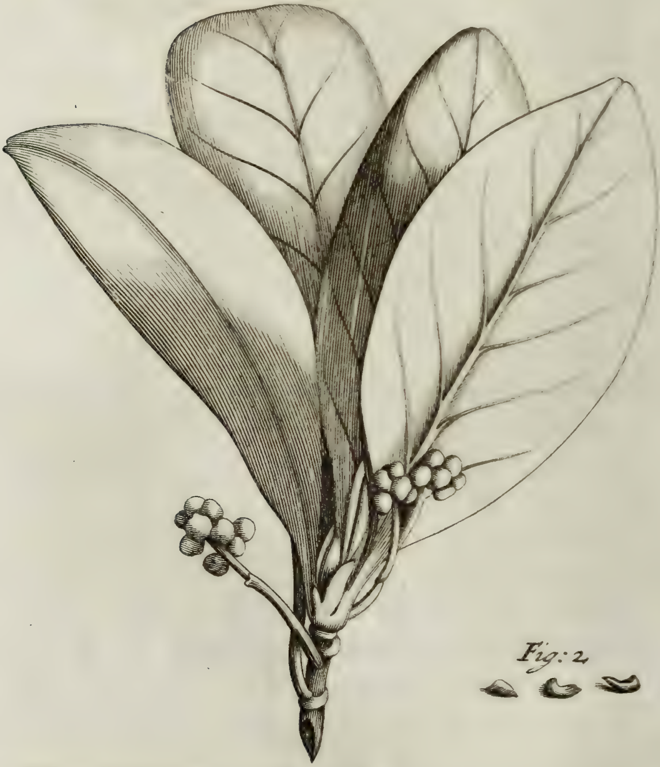

Fig:2

PHILOSOPHICAL TRANSACTIONS.

For the Month of October, 1693.

The CONTENTS.

I. A*N Account of an Experiment made before the* Royal Society *of the Change of Colour, in a pale tranſparent Liquor, to a deep Blue, applyed to illuſtrate ſome Changes of Colour, and other Effects on the Blood of Reſpiring Animals, by* Fred. Slare, M. D. *and* S. R. S. *and Cenſor of the Colledge of Phyſicians.* II. *An Abſtract of a Letter from Dr.* William Oliver, *concerning the ſtrange Flowing and Ebbing of a* Well *near* Torbay. III. *A Second Letter from the ſame Perſon, giving a farther Account of the ſame* Well, *as likewiſe of a Storm of Thunder and Lightning in the* Bay *of* Biſcay; *both Communicated by* Walter Moyle, *Eſq;* IV. Emendationes ac Notæ in vetuſtas *Albatênii* Obſervationes Aſtronomicas, cum reſtitutione Tabularum Luniſolarium ejuſdem Authoris. Per *Edm. Halley*, S. R. S. V. *An Account of the true* Cortex Winteranus, *and the Tree that bears it, by* Hanſ. Sloane, M. D. *and* S. R. S. VI. *An Account of a Book;* Pharmacologia ſeu Manuductio ad materiam Medicam in quâ Medicamenta Officinalia, &c. deſcribuntur, &c. à *Sam. Dale. Lond.* in Octavo, 1693. Impenſis *S. Smith* & *B. Walford*, R. S. Typogr.

I. *An Experiment made before the Preſident and Fellows of the Royal Society, in which a ſurprizing change of Colour from a pale Tranſparent or Clear Liquor, to a very Blue Ceruleous one was exhibited, and that in an inſtant, by the admiſſion of Air only: Apply'd to illuſtrate ſome changes of Colour, and other Effects on the Blood of Reſpiring Animals. By* Fr. Slare, M. D. *Fellow of* R. S. *and Cenſor of the Colledge of Phyſicians.*

IN order to the making of this Experiment, the Operator ſhould furniſh himſelf with a quantity of Filеings of Copper freſh made, and place them in a Glaſs Vial, whoſe bottom is broad and even, and then pour on a Urinous Spirit, either of *Sal Armoniac*, or of Urine it ſelf, not made with Quick-Lime: The Glaſs ſhould not be fill'd up much above one half-way, and then muſt preſently be ſo exactly ſtopt that no Air be capable of intruding; for if you err in a Circumſtance the Experiment will not ſucceed. The Foundation of this Experiment is juſtly due to the Immortal Mr. *Boyle*, but our Aims are very differing in the Application, as well as in the manner of preparing and exhibiting the Experiment. He was ſearching after ſome hidden proprieties of the Air, and particularly apply'd it to the broken or leſſen'd Spring of the Air, which this *Phænomenon* afforded his Speculation. But I have endeavour'd to bring it home to my own Profeſſion, to juſtifie a Notion of ſome Importance, tho' much diſputed, concerning an alteration made by the Air upon Humane Blood, both as to Colour,

lour, and other Vertues. You have alſo this difference in the manner of exhibiting, in Mr. *Boyle*'s Experiment you have the Fileings of Copper contiguous with your *Menſtruum*, in ours you have a clear Colourleſs Liquor, and no Materials at all in your Glaſs to give the leaſt Umbrage to this ſudden change of Colour; but this cannot be performed without ſome *Encheireſis* and an *Apparatus* extraordinary.

'In making the Experiment you will obſerve, for 'four, five, or ſix days the Tincture will be growing 'deeper and deeper, and then will keep a ſtand for two 'or three days more or leſs, and afterwards will gradual- 'ly decline until it become quite pale, and void of all 'Colour. When it is in this ſtate, the eaſieſt way of 'performing the Experiment for your own ſatisfaction, 'is to decant this clear Spirit into a Glaſs ſo as to leave 'all the Fileings behind, and that will demonſtrate that 'the Fileings did not give this Tincture *de novo*, but that 'it belongs to the influence of the Air. But in caſe you 'are furniſh'd with an Air-pump, and can pour off this 'palid Liquor in a *Vacuo Aeris*, and there ſtop it up ſe- 'curely, you may then preſerve it ſo long as you pleaſe, 'and exhibit it to advantage, which is the way I com- 'monly uſe. You may alſo obſerve, that ſo ſoon as 'you let in the Air, the upper Superficies immediately 'tinges firſt, and ſo deſcends deeper and deeper until it 'has penetrated the whole, and this it does the ſooner, if 'the Glaſs be wide, and the Liquor by conſequence have 'a large Superficies: Or if you pour it out of one Glaſs 'into another, the Air makes a more ſudden change of 'the whole.

That Liquors ſhould loſe their Tinctures is not to be wonder'd at, for even Ink it ſelf by ſtanding ſtill will loſe much of its Tincture, and ſo do the Tinctures of many Minerals, Tincture of Sulphur, and of Salt of Tartar will loſe their Tinctures, and many Vegetables are not long to be preſerved, but do grow turbid, ſome pale, and colourleſs, and leave their *Menſtruums*, and precipitate to the bottom, and are not eaſily if ever recover'd. But in our Experiment we have ſome things very uncommon, a deeply ting'd Liquor grows pale and colourleſs in a few days, without any admiſſion of Air or any other Ingredient to diſturb it, or to cauſe any diſcernable precipitation or ſeparation. Yet when I conſider that two Grains of Copper will give a deep Colour to three Ounces of Urinous Spirits, we need not expect any great quantity ſhould be diſcharg'd out of the Liquor to be very conſpicuous at the bottom, which does better ſolve it than a bare change of Texture can do; namely, to allow it to ſubſide to the bottom of the Glaſs, tho' it be ſcarce perceptible by reaſon of the Fileings that may conceal it. But a yet greater difficulty emerges to account for, which is, That ſince our *Menſtruum*, (that is, our Spirit) is diveſted of its Venereal Particles, which gave the Tincture, and is become as clear as Rock-water, and being ſeparated from its Metalline Fileings, does yet upon the approach of the Air immediately afford a very Blue Tincture. This indeed plainly ſhews, that there muſt be conceal'd in the Pores of the Liquor, ſuch Particles as are of a Cupreous Nature. But how may this come to paſs? To which I anſwer, I cannot be ſo vain to think, that the Air gives the matter of the Colour to the Spirit, but that it conveys into it ſuch Particles as do ſtimulate and give motion to the *Menſtruum*, and inable it to diſſolve thoſe Particles thoroughly, that for want of more Air had not been fully broken in pieces.

In the next place, I diſcover two very differing ſorts of Matter that our Urinous *Menſtruum* acts upon in this Experiment. One I call a Sulphureous Matter, which gives the Blue Colour, and does let it fall again; and another which deſerves the name of *Saline*; but tho' it be taken up into our tinging Spirit, does yet notwithſtanding afford no Tincture whilſt ſecluded from the Air: This was made to me very plain and clear, for having found out a way to ſeparate a white ſlimy ſubſtance out of our clear Liquor, I then deſtroy'd the Experiment, ſo that when expos'd to the Air the *Menſtruum* would no more give the leaſt Tincture: For a farther confirmation, this white Saline Subſtance being in a ſmall quantity diſſolved in any proper Urinary *Menſtruum* exhibits the Experiment ſet down to advantage, and gives a much finer and brighter Colour than what is drawn from Crude Copper, or from the Sulphureous parts: But ſince the method above is more feaſible, I will not ſpend time for fear of diſcouraging the Undertaker of an Experiment, to ſet down this very elaborate method of procuring the Salt of *Venus*.

The great Intereſt the Air has in this Experiment made me think of applying it to the great change that is made upon Blood; for it is obvious to every Body that there is a great difference in Colour betwixt the Venal and Arterial Blood, the Venal ſo ſoon as it is let out of the Vein is obſerved to be of a dark Complexion, and requires ſome time to be expos'd to the Air before it obtains a florid Red, and that only Superficies which is contiguous to the Air, does for a good while become Red; for I have turn'd up a Cake of Blood twenty four hours after it had been let out, and found it of a very dark and opake Colour, but the Air has immediately given it a bright and florid Red Tincture. This ſo maniſeſt a change made by vertue of the Air is obvious even *Lippis & Tonſoribus*, which would make one wonder to find great Philoſophers and Anatomiſts endeavour to aſſign more forreign and ambiguous Cauſes of ſo demonſtrable an effect of the Air. Thus our Famous Anatomiſts Dr. *Highmore*, and Dr. *Needham*, and others, have adventur'd to do; who would have reſpiration to be chiefly to promote the Circulation of the Blood, and that great *Apparatus* of Air-Veſſels to be for a Fan to cool the Maſs of Blood, and that the Air returns unalter'd, and not capable of making any great alteration, being denied any ingreſs into or mixture with the Blood. The Obſervation is certain and unerring, that the Venal Blood as it paſſes the Right Ventricle at its entrance into the Lungs is of a very opake and blackiſh Complexion, and in its paſſage through the Lungs before it comes to the Left Auricle, is changed into a very florid and bright Red. I have often obſerved that Perſons that have Vomited Blood upon a Rupture of ſome Capillary Veſſels of the Lungs, have ſent up a very froathy or ſpumous Blood,and at the ſame time of a bright Scarlet Red: That it was froathy, argues that the Air had incorporated with it; that it was Red was due to the tingeing power of the Air. To expect that this change ſhould be made in the Heart by any Local Ferment, or *flamma vitalis* is fruitleſs; becauſe we find it performed before its arrival there; the ſtructure of the Heart denoting that Engine to be principally made for projecting the Blood in order to a Circulation through thoſe various Arteries or Pipes which are branched from the Heart. Let us therefore examine the ſtructure of the Lungs, and very briefly conſider them, we ſhall ſoon diſcover it to be a Pneumatic Engine made principally for taking in Air, and that in great quantities, which a Remark in the Fourth Corollary does much favour. It's true, we may call the Lungs a Contexture of Veins, Arteries, Nerves, Lymphæducts, &c. and that theſe do very much make up the Parenchyma (as ſome do uſe the word) of the Lungs; but yet we ſhall find the great bulk of the Lungs to be Veſicular: It ſeems to me to be a Continuation of the *Aſpera Arteria,* or Wind-pipe, divided and ſubdivided into many Branches, and theſe ſtill ſpun out into leſſer and leſſer Pipes, all of them hollow; the farther they run the thinner their ſides do grow, which upon the Inſpiration of Air do ſwell up and grow round, and upon expiration do fall ſomething flaccid, and abate ſomething of that Figure, as the Microſcope does plainly repreſent. That theſe Pipes ſhould run to a great length hollow, tho' very ſmall, I the leſs wonder at, having ſeen a hollow Pipe of Glaſs drawn out at the flame of a Lamp ſo very ſmall as to be ſcarce viſible without a Microſcope, and yet was ſo hollow as to take up tinged Spirit of Wine, where only the ordinary preſſure of the Ambient Air impell'd it. Nor will compreſs'd Air be kept out where there is the leaſt Pore left open, which makes it more than probable that it ſhould inſinuate into this Machine ſo truly adapted to receive the Air, and that in great quantity, the *Apparatus* of Air-Veſſels being ſo very conſiderable, which appears in each inſpiration; for the Luugs are ſtretch'd at that rate as to take up double the room they do in the ſtate of expiration, or in their compreſs'd ſtate; and even in this ſtate the Air-bladders are not fully evacuated, but contain Air for good purpoſes. Nor can it be pretended that any augmentation is due to the Expanſion of the Blood-Veſſels, or any other which do not ſwell beyond their uſual Tenſion in each inſpiration. The Sanguiferous Veſſels are divaricated through all the Lobes of the Lungs, and do give a very cloſe attendance to each *Veſicula* (for there is not the leaſt *Veſicula* but has a Capillary Veſſel which intimately inſinuates into it) in order to receive ſome conſiderable benefit from it; and this appears to the Eye, for in an inſtant a dark and foul Blood is changed into a bright florid Red Colour, which would make a Man of Contemplation to admire it, and a Lover of Red Wine, who is preſently offended to ſee his Liquor foul, (and perhaps juſtly condemns it for unwholeſome) wiſh for ſuch another expedient to clear up his turbid Liquor. Thus the very ſtructure of the Lungs, the effect of change of Colour both in the Blood and in our Ex-

Experiment, the one from a dark opake Colour to a noble Scarlet Dye ; the other from a pale or colourleſs Liquor to a rich *Ultra Marine* Blue, do all combine to do juſtice to the Air for this celebrated alteration. Nor is the Air thus infus'd into the Lungs for a bare Colour, and of no farther conſideration: But I am apt to believe the great Fermentations of the Blood the cauſe of the Motions and Actions of the Muſcles ; the Animal Spirits themſelves, the great Spring of Motions, derive their Energy and Powers, if not Nature, from hence.

COROLLARY I.

The Air is full of Volatile Salts none will deny, but that theſe Salts muſt bear the name of Nitrous Salts, it has been ſcarce call'd in queſtion, which this Experiment and ſome others I have made, do. Nitrous Salts ſeem to me not to have any property of Volatile Salt : Nitre is a Salt of ſo fixed a nature, that it will continue melted in a very ſtrong Fire with ſcarce any Evaporation ; but if you put into it Charcoal, or Brimſtone, or give it an Accenſion by another Eucheireſis you may obtain a great quantity of as fixed a Salt as any Concrete whatever affords; ſo that to me Gold ſeems not of a more fix'd Nature.

COROLLARY II.

A ſtandard of Volatile Salts ſhould be ſetled, at preſent I can think of none better than Water. That Salt which in Diſtillation is more fix'd than Water, ought not to be reckon'd amongſt Volatile Salts : This ſtandard will be juſtified by good meaſures, grounded on Experience ; for all Salts that are truly Volatile, as far as I could obſerve, are really lighter than Water, that is in a Chymical ſenſe, do with a leſs degree of Fire ſublime in our Glaſſes, or come over the Helm, than Water does. This I find juſtified in our Volatile Salt of Amber erroneouſly ſo call'd, for it does not come up to our ſtandard of Volatility, and is really no Volatile Salt, as will be made appear: If you take this ſuppoſed Volatile Salt and Diſtil it in a Retort, or Head, and Body, with common Water, the Water will aſcend in ſuch a degree of Fire where the Salt will not, for you muſt increaſe your Fire conſiderably to make it riſe after the Water is gone, and has left the dry Salt at the bottom. This made me enquire farther into the properties of this Salt, which did not at all Correſpond with Volatile Salts (for all true Volatile Salts are Alkalies) but on the contrary would ferment with them, and quite deſtroy the property of true Volatile Salts, by bringing them to a dull inſipid Salt, which ſome call *Sal Neutrum*; and alſo by fixing their Volatile Nature, not only in putting them by the ſtandard of Volatility, but alſo does quite deſtroy their ſpiritous and ſtimulating ſmell, by vertue of which they have been always deſervedly eſteem'd ſuch excellent Cephalick Medicines. Therefore examining this Salt yet a little farther, you will plainly prove it to be an Acid, that Corrodes Iron, turns Syrup of July-flowers Green, deſtroys the Tincture of *Lignum Nephriticum*, and does not ferment with common Acids; ſo that it plainly belongs to the Tribe of Acids, and ſhould be ſtruck out of the Catalogue of Volatile Salts; and perhaps out of the number of Specific Cephalicks, and rather be degraded amongſt the Diureticks, and even in that rank to have but an inferior ſtation; for it ſeems to me to be but a dull Medicine, and more Valuable for its Price than great Vertue, eſpecially if quite diveſted of all its Oyl, in which the great *Cephalic* and Cordial Vertue muſt needs be own'd to conſiſt.

COROLLARY III.

That Volatile Salts have a great property to draw Tinctures, and do particularly advance thoſe Colours that are diſpos'd to be Red: For tho' Spirit of Wine be a very Catholic *Menſtruum*, and draws a very deep Tincture of Cochinel, yet we have often obſerved that if we put to this Tincture, when higheſt, a ſmall proportion of Volatile Salt that would advance it to a great, even a double degree. Thus I have obſerved it to advance the Tincture of Arterial Blood; and which is very Curious, if you diſſolve it in your Blood whilſt you are Bleeding at one of your Veins, that Blood will become very florid, and like Arterial Blood. Therefore ſince Nitrous Salts produce none of theſe tingeing Effects; this Corollary ſeems much to favour the Notion, That the Effects of the Air upon the Blood, may be due to ſuch Salts as are of a Volatile Alkaliſat Nature.

COROLLARY IV.

Contagious Diſeaſes are Communicated by the Air inſpired at the Lungs; and this ſeems more probable than what Dr. *Needham* and others, have endeavour'd to make out with more difficulty; in attributing the ſame effect to the Air taken in our Meat by Maſtication, and ſwallow'd down in our Drink, and communicated to our Chyle from thence to our Blood and Spirits; but this way a very ſmall quantity of infected Air is Communicated, if we compare it with what is Communicated to the Lungs: For in each inſpiration, Humane Lungs of an ordinary ſize do at leaſt take in ſuch a quantity of Air as will fill up a Quart Bottle, and in the ſpace of a Minute I have made Twelve Reſpirations, (when I was very ſedate, and drew in my Breath very treatably) and in that time by conſequence took in as much Air as would fill up a Veſſel capacious enough to hold three Gallons of Water ; and it's plain that the Air expired returns much alter'd, for as much as the Breath or *Halitus* returns impregnated with a moiſt Vapour, and ſuch a one as does many times indicate the Temper of the Blood : From this *Halitus* Impoſthumations of the Lungs are frequently predicted : Such as have Sulphureous Blood ſhall emit no very pleaſing but rancid Exhalations : Nor does the Blood only clear it ſelf of ſome Vapours in expiration, but alſo imbibe, and impregnate it ſelf with ſuch Particles as are neceſſary to maintain Life in inſpiration ; for a Man could not ſubſiſt long in a Tun of Air, ſhould he be kept cloſe in ſo capacious a Veſſel, as we have found by Experiments made with ſeveral reſpiring Animals , Dogs , Cats, and Birds, *&c.* that theſe would ſoon die there ; ſo that we need conſtant ſupplies of vaſt quantities of freſh Air , which makes me believe that thoſe Particles ſeparated out of the Air by the Lungs are very ſparingly deliver'd or mix'd with the common Air, but yet with this difference, that the more compreſs'd the Air is, the more it contains of that vivifying Salt or Spirit, and the contrary, the more rarified the leſs is found ; for we are told by the Experience of ſuch as have been on the Pike of *Teneriff*, that their breathing is more difficult there than at the bottom, where the Air is more compreſs'd. And we have found Birds and Mice, *&c.* would live as long again, in a Veſſel where we had crouded in, by a Syringe (or any other condenſing Engine) a double quantity of Air, as they did where they were confined only to common Air. To conclude, ſince the vivifying Particles in the Air ſeem to be very ſparingly diſſeminated through it, I am apt to believe that the Noxious and Peſtilential are more ſparingly ſcattered up and down ; (the Author of Humane Nature having taken more care for its Preſervation than for its Deſtruction) and therefore it may much better be inferr'd from the Premiſes, That Contagious Diſeaſes muſt needs be communicated to the Blood by Inſpiration into the Lungs, rather than any other way.

II. *An Extract of a Letter from Dr.* William Oliver, *Communicated by* Walter Moyle, *Eſq*;

Torbay, *the* 15*th.* *of* July, 1693.

SIR,

WHen we Cruiſed in the Bay of *Biſcay*, *June* the 8*th*, and had a hundred Fathom of Water, we took a Quart Glaſs Bottle ſtopt with a large Cork, and after tyed down with a ſtrong Packthread, as we uſe to for Bottle Syder, or Ale, faſtening our Bottle to our Plumbing-rope, and with a Lead at the end, ſunk it to the bottom of the Sea, which as ſoon as we perceiv'd, we drew it up again, and found the Cork quite preſs'd thro' the neck of the Bottle into its cavity, and the Bottle full of Salt Sea-Water. We repeated our Experiment with another Bottle and Cork in the ſame manner as before, but the Cork being not ſound, the Sea-Water ſoak'd thro' it, and the Bottle was half full of Water, ſo the Cork remain'd in the mouth of the Bottle not preſs'd down at all. We repeated our Experiment a third time in ninety Fathom of Water, with a very ſound Cork, and much larger than the mouth of the Bottle, for we were forc'd to beat it in with a Hammer as far as it would go, leaving about an inch of the Cork above the mouth of the Bottle, and tyed down as before, but it ſucceeded not ſo well as at firſt, tho' the Cork was now preſs'd down into the neck, and became level with the mouth of the Bottle ; and I really believe, had we ten or twenty Fathom of Water more, 'twould have ſucceeded as well as our firſt Tryal. I ſend you not this as an Experiment altogether new to you, and ſhall inſiſt no longer on it, but proceed to an uncommon *Phænomenon* I met with near this place. Going a-ſhoar one day laſt Week to breath a little Land Air, I walked about a Mile into the Country to ſee a Well much talked of in theſe Parts,called *Lay-Well*,which made me more than amends for the pains I had taken to come at it. This Well is about ſix Foot long, five Foot broad, and near ſix Inches deep, which ebbs and flows very often every hour, viſibly enough ; for from high Water to low Water-mark, which I meaſured, I found it ſomewhat more than five Inches. I could not ſee any augmentation above my mark when it flowed, nor fell it below my mark when it ebb'd, but always kept the ſame diſtance. I obſerved the Time as well as I could, but having no Minute-Watch nor Glaſs, I could not meaſure that ſo exactly, but really judg'd the flux and reflux, taken both together, was performed in about two Minutes ; nothing could be more regular, each ſucceeding the other as the Tides of the Sea do : The next time I go a-ſhoar I'le have a Minute-Glaſs, and be more exact. I drank of it, and found it a pleaſant, delicate, fine, ſoft Water, not brackiſh at all, which the Country People uſe in Fevers as their ordinary Diet-drink, which ſucceeds mighty well.

III. *An Extract of a Second Letter from* Dr. Oliver, *Communicated by* Walter Moyle, *Eſq*;

Spithead, the 9th. of *October*, 1693.

S I R,

I Went once more to the Well to make my Obſervations, when we lay laſt in *Torbay*, and having a little more time than I had before, tho' little enough for ſo odd a *Phænomenon*, I ſhall anſwer thoſe Queſtions you were pleaſed to ſend me as well as I am able.

Queſt. *Whether the Flux and Reflux be conſtant, at all times of the Day and Year, or only after Rain? And what Account the Country People give of it?*

Anſw. By every Body I met with, I am informed 'tis moſt conſtant Winter and Summer, tho' I am apt to think, it moves faſter in Winter, when the Well is fuller, than in Summer, becauſe when I obſerved it firſt, I think it flow'd ſomewhat quicker, than I found it did on my ſecond Obſervation, which was above ſix Weeks later in the Year, being towards the end of *Auguſt*; for the Water was then conſiderably ſhrunk in the Well, notwithſtanding we had for about a Fortnight much Rain: And tho' when once it began to flow, it perform'd its flux and reflux in little more than a Minutes time, yet I obſerved it would ſtand at its loweſt Ebb ſometimes two or three Minutes, ſo that it ebb'd and flow'd by my Watch about ſixteen times in an hour, and ſometimes, I have been told, twenty. As ſoon as the Water in the Well began to riſe, I ſaw a great many bubbles aſcend from the bottom, but when the Water began to fall, the bubbling immediately ceaſed. I meaſured its high and low-water marks again, and found them as before, between five and ſix Inches diſtant; not of Perpendicular depth, but as it ſpread itſelf on a broad Stone, as the Sea does on a Beach or Shoar; tho' I am apt to think, its Perpendicular height would be as much or more in that time, were its out-let damm'd up to try an Experiment, for as it riſes it runs out with a ſmall ſtream, which is greater or leſs, according as the Water in the Well riſes and falls, which ſoon after joyning ſome other little Rills thereabouts, that come out of theſe Hills, they empty themſelves into the Sea at *Brixam.*

Queſt. 2. *Whether it has any Communication with the Sea, or any Hills above it?*

Anſw. That it has any Communication with the Sea, is not manifeſt, nor is the Water brackiſh at all. The whole Country adjacent is very Hilly all along the Coaſt, inſomuch that from *Brixam* to the top of the Hill is about a Mile and half, the Well is about half way up the Hill, which hereabout is ſomewhat uneven and interrupted, and comes out at a ſmall deſcent, yet conſiderably higher than the ſurface of the Sea.

Queſt 3. *Whether it be a Mineral Water?*

Anſw. I cannot apprehend 'tis impregnated with any manner of Mineral: I tryed it with an Oaken Leaf as ſoon as I ſaw it the firſt time, but could not find it change colour. I drank of it, 'tis very ſoft and pleaſant, has no manner of roughneſs in it, and ſerves for all manner of uſes to the Country People in their Houſes. I could not make any farther Experiments for want of Time and Opportunity.

Give me leave before I finiſh this, to tell you of one of my Adventures at Sea this Summer, 'tis Philoſophical too.

The 12*th.* of *Auguſt* laſt I was ſent for on Board the *Suffolk,* to viſit ſome that were ſick, the Weather proving foul, was obliged to lye there that Night: In the Morning about Three a Clock it began to Thunder and Lighten, and Rain, which continued for near an hour moderate enough; but about Four a Clock came a Clap of Thunder and Lightning all at the ſame moment of time, that was ſo ſmart and violent, that I thought the Ship had been ſplit in pieces, and jumpt out of Bed, put on Stockings and Shoes, to ſee what the matter was, I no ſooner got out of my Cabin, but an Alarm went through the Ship, of *Fire! Fire!* the dreadfulleſt word that can happen on Board, and put us all into Confuſion. The Sick, and all that were in Hamocks, came up on the Deck in their ſhirts, and made a grievous Noiſe; Thunder and Lightning going before, made it look like a Reſurrection: It happened to Rain briskly about that time, and ſo with the help of our Buckets, the Fire, which was occaſioned by the Balls of Lightning that came between Decks, was ſoon put out; this happened in the Bay of *Biſcay*, in 47 and 48. *gr.lat.* I lay at that time forward near the Maſt, in one of the Officers Cabins; over my head in the Gang-way was one Man knockt down, and lay ſome time before he recovered himſelf: A ſecond near him was blown almoſt the length of the Quarter-deck, a third was burnt all down his Back with the Lightning in his Hammock. Our Main Top-Gallant Maſt was ſplit in pieces, our Top-Maſt not touch'd; our Main-Maſt ſplit from the top down to the very Deck. I made what haſt aboard the *Elizabeth* I could, and that very Morning our Lieutenant in this Storm jumped over Board, as you have heard.

IV. Emendationes ac Notæ in vetuſtas *Albatênii* Obſervationes Aſtronomicas, cum reſtitutione Tabularum Luniſolarium ejuſdem Authoris. Per *Edm. Halley*, S. R. S.

C*VM inter Monumenta Veterum nihil uſpiam reperiatur Obſervationum Aſtronomicarum niſi apud* Claudium Ptolemæum, *cumque etiam nullas alias in Syntaxi ſua tradiderit, præter eas quæ Theoriis ſuis comprobandis uſui erant, cæteras vero permultas ſine dubio à* Timocharide, Hipparcho *aliiſque poſteritati conſignatas, inſigni Scientiæ detrimento ſuppreſſerit; haud abs re fore videtur,* Albatenii *ſive ElBatêni (ut Arabice ſonat) medio præciſe loco inter nos ac* Ptolemæum *florentis, ac* Ptolemæi *Sphalmata primum corrigere auſi, Cæleſtia Obſervata in lucem promere, atque à traductoris vel Typographi vel utriuſque mendis quâ potui diligentiâ liberare.*

Author iſte ſane pro ſuo ſæculo admirandi acuminis, ac in adminiſtrandis obſervationibus exercitatiſſimus, ut apparet ex eo quod Solis motum, captis Æquinoctiorum momentis, penitus reſtauraſſe videretur, ſi longius Ptolemæi *veſtigiis abcedens, Eccentricitatem Solis biſecandam eſſe vidiſſit. Liber quem patrio ſermone conſcripſit ſaltem apud nos non reperitur; ante aliquot ſæcula vero ex Arabico in Latinum tranſtulit quidam* Plato Tiburtinus *neque Linguarum ſatis ſciens, neque Aſtronomicâ diſciplinâ inſtructus, ut ex ipſo opere conſpicuum eſt. Hujus autem traductionis binas vidi editiones, alteram* Noribergæ *Anno* 1537. *alteram* Bononiæ *Anno* 1645. *ſed ex priori omnino deſumptam, cum etiam errata omnia Typographica prioris conſervet, licet Bibliothecæ Vaticanæ exemplar prætendatur. Vtcunque ſit, utraque Editio crebris ſcatet mendis, præſertim quoad Numeros, atque utraque Tabulis Aſtronomicis Authoris, quarum paſſim fit mentio, mutilatur.*

Albatênius *autem in Luna & Planetis Ptolemaicis Hypotheſibus emendandis fruſtraneam operam inſumit ; cumque veriora ſcientiæ Syderalis principia jam nacti ſimus, cætera quidem ejus haud uſque adeo neceſſaria ſunt ; Obſervationes vero ejus quas ſolas habemus, per tot ſæcula inter* Ptolemæum *&* Regiomontanum *lapſa, jure conſervari atq; inter pretioſiſſima Vraniæ* κειμήλια *reponi merentur. Præſertim cum uſus eximios præbeant in demonſtrandâ Temporis Annui inæqualitate ; uti alia occaſione probare ſatago.*

Floruit Albatenius *circa Annum Chriſti* 890. *vigente jam Imperio* Saracenico ; *creditur Vir Nobilis, à quibuſdam etiam patriæ ſuæ Princeps : Vtcunque fuerit, conſtat illum* Syriæ *incolam per plures annos* Antiochiæ *vel* Arractæ *vitam egiſſe : Tabulaſque Aſtronomicas Obſervationibus propriis fretas ad Meridianum* Arractæ *conſtruxiſſe. Vrbs autem iſta propriè dicebatur* Alracca *vel* Alrecca, *tempore* Albulfedæ *deſolata, olim autem magna & celebris fuit, juxta* Euphratem *ſita, ad latus Orientale & Boreale :* Albulfeda in deſcr. Meſopotamiæ. *Conſentiuntque omnes Geographi Arabes ad ripam* Euphratis *poſitam fuiſſe, ſub Latitudine* 36 *gr. quantam ei aſſignat ipſe* Albatenius *Cap. IV. Videturque Vrbs iſta à* Perſis *condita ad tutandam ripam* Perſicam *quo tempore* Romana *poteſtas mole ſuâ ruens in occaſum vergeret.* Antiochiæ *vero* Syriæ *ad* Orontem *ſitus ſatis notus eſt, cum etiam hodie urbs inclyta ſit.*

His in urbibus obſervationes ſuas inſtituit Albatenius, *quas cum malè deſcripſerit qui librum ejus Latinitate fere barbarâ donavit, neque numeros, quod maxime oportuit, curaverit, hortatu R. Societatis non potui hanc emendationem non ſuſcipere, ſimulque Tabulas Aſtronomicas Authoris quæ Solem Lunamque ſpectant, quæque periiſſe videbantur, quantum fieri poſſit, redintegrare. Obſervationes autem ſic ſe habent.*

Primum refert ſe obſervaſſe diſtantiam Tropicorum prægrandi inſtrumento ac omni adhibitâ curâ 47 *gr.* 10 *min.* ſcil. *Solis æſtivi à Zenith minimam diſtantiam* 12°. 26′. *Hiberni vero maximam* 59 *gr.* 36′. *unde etiam elicitur*

Latitudo Urbis Aractæ *36 gr. 1 min. Maxima vero declinatio Solis ſive Zodiaci obliquitas fit 23 gr. 35′, quam tamen, ſine ullo examine, immutatam ſuppoſuere Aſtronomi omnes hoc noſtro ſeniores, qualem* Ptolemæus *ab* Hipparcho *receperat, nempe 23 gr. 51 min. 20 ſec. Cap.* IV. *Deinceps.*

Anno 1194 *Dhilcarnajin ſive Anno* 1206 *ab obitu* Alexandri, *hoc eſt, Anno poſt Chriſtum natum* 882, *die* 19*no Menſis* Elul *ſive* Septembris, 4 h. 45′ *ante Solis exortum, in* Arracta *obſervabatur Æquinoctium Autumnale. Hoc eſt* Septemb. 18° 13 h. 15′ P.M. *Factaq; collatione cum obſervatione* Ptolomæi *Anno tertio* Antonini *habita, hoc eſt Anno Chriſti* 139 Sept. 26. *horâ unâ poſt ortum Solis, ſive* Sept. 25° 19 h. Alexandriæ, *ex intervallo* 743 *Annorum, colligitur ſpatium Annuum ſive quo Sol ad æquinoctia revolvebatur.* 365 *dierum* 5 h. 46′ 24″, *motumq; ejus in Anno communi* 11 s. 29° 45′ 46″ 25‴ $\frac{1}{3}$, *aliquantum juſto celeriorem. Quod quidem evenit ex eo quod* Ptolemæum, *arte ac induſtriâ ne dicam fide* Hipparcho *longe inferiorem, hoc in negotio prætulerit; cum ſcilicet jam pro comperto habeamus* Ptolemæi *æquinoctia nullo modo cum aliorum obſervationibus conciliari poſſe, ut potius ficta quam cælitus deprompta credere liceat. Hæc Cap.* XXVII. *traduntur.*

Deinde Cap. XXVIII. *refert* Albatenius *Æquinoctiorum intervalla, qualia multo labore ac diligentiâ ipſe plurium annorum repetito experimento determinaverat. Scil. ab æquinoctio Autumnali ad Vernale intercedere* 178 *dies* 14 h. 30′, *a Vernali vero ad Autumnale æquinoctium* 186 *dies* 14 h. 45′, *cui etiam plus fidei adhibet Author. Eademq; curâ Solis in quadrante vernali moram, ſive a principio Arietis ad Solſtitium æſtivale, definivit* 93 *dierum ac* 14 *horarum. Ex quibus datis, calculo debite inſtituto, totam Solis Eccentricitatem* 2° $4'\frac{3}{4}$ *ſtatuit, qualium Radius Eccentrici eſt* 60 : *vel* 3465 *qualium radius eſt* 100000. *Apogæon vero Solis tunc temporis, viz. Anno* Chriſti 882, *Geminorum* 22 gr. 17′ *tenuiſſe ſimiliter demonſtratur ; idq; mobile, una cum ſtellis fixis, ſingulis* 66 *annis Julianis gradum unum conficere docetur, Cap.* XXXIII. *ac* LI. *unde provenit motus ejus annuus* 54″ 33‴

His poſitis principiis numeros Albatenii *qui Solis motum ſpectant haud difficulter reſtaurare poſſumus. Ac inito calculo proveniunt Radices motuum, ineuntibus Annis Chriſti, ſub Meridiano Arractenſi.*

Anno	*Apog* ☉				*Med. motus* ☉			
Chriſti	*s*	°	′	″	*s*	°	′	″
881	2	22	16	5	9	14	24	42
882	2	22	17	0	9	14	10	28
883	2	22	17	55	9	13	56	14
891	2	22	25	12	9	14	0	42
901	2	22	34	19	9	14	35	52

Logarithmus autem pro æquatione Solis 9.969888.

Ut autem corrigantur Librorum impreſſorum graviora errata ſenſumq; turbantia, præſertim in Numeris ubi de Solis motu argumentatur, utramq; Editionem ſic emenda.

Edit. Bonon		*Edit. Norib.*			
pag.	*lin.*	*pag.*	*lin.*	*pro.*	*lege.*
66	15			20 *dies.*	70 *dies.*
	21	27 b	7	300.	300 *annos.*
	28		13	*Tamenith.*	*Phamenoth.*
	31		15	36 *modo.*	463.
	31		16	*Mufræ.*	*Meſori.*
67	5		25	60 *annos.*	600 *annos.*
	11		31	186.	286.
68	7	28 a	18	31 *quart.*	32 *quart.*
	19		28	55 *quint.*	53 *quint.*
69	18	28 b	11	14 *horis.*	14 *hor.* 45′
70	19		31	*PKLM.*	*PKLMT.*

Edit. Bonon		Edit. Norib		pro.	lege.
pag.	lin.	pag.	lin.		
70	25	28 b	37	80.	180.
	31		42	6 *ſecund.*	10 *ſecund.*
	32			59 *min.*	58 *min.*
71	12	29 a	23	59 *ſec.*	29 *ſec.*
	17		30	58 *min.*	59 *min.*
201	*ult.*	79 b	38	2 *gr.* 22 *min.*	5 *gr.* 55 *min.*
202	11	80 a	6	20 *min.*	50 *min.*

Ex hoc ſpecimine conjectare licet quali caſtigatione indigeat liber iſte, cum tam paucis paginis etiam numeri toties vitiati reperiantur : ut taceam verborum ac literarum errata ut leviora.

Præcipuas vero Obſervationes ſuas tradit Cap. XXX. *quatuor ſcilicet Eclipſes, duas Solares totidemq; Lunæ.*

Primæ Solaris medium obſervatum eſt Arractæ *Anno* 1202 Dhilcarnajin *ſive ab obitu* Alexandri 1214, *hoc eſt, Anno* Chriſti 891, *die octavo Menſis* Ab *ſive* Auguſti, *horâ unâ temporali poſt Meridiem; hoc eſt (occidente Sole horâ 6 h.* 45′) 1 *h.* $7'\frac{1}{2}$ P.M. *ac tum defecit in Sole plus duabus tertiis vel octo digitis. Tempore autem veræ Conjunctionis, quam medium Eclipſis octavâ horæ parte præceſſiſſe computat, ſive* 1 *h.* P. M. *æquate vero* 1 *h.* 4′ *juxta* Albatenii *Tabulas motus ſupputati ſic ſe habebant.*

	s.	°	′		°	′
Solis Locus medius	♌	20	54			
Solis Locus verus	♌	19	14			
Lunæ motus medius	♌	17	6	*pro*	17	50
Anomalia Lunæ correcta	11	3	7	*pro*	2	57
Argumentum Latitudinis medium	5	24	43			
Argumentum Latitudinis verum	5	26	51	*pro*	26	11
Ideoq; tempore medii Eclipſis	5	26	55	*pro*	27	11
Unde Latitudo ☽ *vera Septentrionalis*	0	0	16			

Concluditque numeros Ptolemæi *integrâ horâ citius quam obſervatum eſt, hanc Eclipſin repræſentare.*

Alterius Solis Eclipſis medium Antiochiæ *viſum eſt, Anno* Dhilcarnajin 1212 (*pro* 1205) *ſive Anno à morte* Alexandri 1224 (*pro* 1554) *hoc eſt, Anno Chriſti* 901, *die* 23° *Menſis* Canun (*non* Huni) *ſecundi, ſive* Januarii, $8^{h}.20'$ *A. M. vel* Januarii 22°. $20^{h}.20'$. Arractæ *vero* $20^{h}. 32'$. *Ac quantitas deficiens parum excedebat centrum Solis ſive ſex digitos. Mediumque Eclipſis* 50 *minutis (non horæ dimidio, ut habent libri impreſſi, pro dimidio ac tertio) veram conjunctionem præcedere debuit, quam proinde fuiſſe conſtat* $21^{h}. 22'$. Arractæ: *Tempore vero æquato* $21^{h}. 37'$. *quo Motûs ex Tabulis Authoris ſic inveniuntur.*

	s	°	′		s		′
Locus Solis medius	♒	7	9				
Locus Solis verus	♒	8	35				
Lunæ motus medius	♒	12	49				
Anomalia Lunæ correcta	4	6	35	*pro*	5	6	55
Argumentum Latitudinis medium	5	23	25	*pro*	5	23	55
Argument. Lat. verum	5	19	11	*pro*	5	19	41
Ideoque tempore medii Eclipſis	5	18	45				
Unde vera Latitudo Lunæ Borea		0	59				

Secundum Ptolemæi *vero numeros hanc Eclipſin totis duabus horis tardius contingere debuiſſe affirmat.*

Ex Eclipſibus Lunaribus prima obſervata eſt Anno 1194 Dhilcarnajin, *vel* 1206 *à Morte* Alexandri, *ſive Anno Chriſti* 883. *die* 23° *menſis* Tamuz (*pro* 53 Temur *vel* Zemur) *vel* Julii· *Mediumque in* Arracta *apparuit* 8 *horas & aliquid amplius Poſt Meridiem; pone* 8 *h.* 5 *min. id eſt, æquate* 8 *h.* 9 *min. Defectuſque parum ultra decimum digitum attigit. At juxta Numeros Authoris tenuere tunc temporis.*

	s	°	'		°	'
Sol medio motu ſuo	♌	5	21	*pro*	5	51
Locus ejus verus	♌	4	1	*pro*	4	5
Luna autem medio motu	♒	8	45			
Anomalia Lunæ media	3	23	8	*pro*	93	0
Anomalia autem correcta ſive æquata	3	24	10	*pro*	94	10
Argumentum Latitudinis medium	6	10	49			
Argument. Latitudinis verum	6	6	5			
Unde Latitudo ☽ Auſtrina		0	32			

Error autem Ptolemæi *in hac Eclipſi,eſt trium horæ quadrantium, quibus Medium citius obſervato ex numeris ejus ſupputatur.*

Secunda vero Lunarium erat Anno 1212 Dhilcarnajin, *vel* 1224 *à morte* Alexandri, *Annove* Chriſti 901, *die ſecundo Menſis* Ab *ſive* Auguſti ; & *Obſervabatur Medium* Antiochiæ 15^h. $20'$. *P. M. id eſt,* Arractæ 15^h. $35'$ *fere, æquate vero* 15^h. $39'$. *Ac Luna fere tota deficere viſa eſt. Tunc temporis Elementa calculi juxta* Albatenium *colliguntur.*

	s	°	'		°	'
Solis Locus medius	♌	16	10			
Solis Locus verus	♌	14	36			
Lunæ Locus medius	♒	19	24	*pro*	19	54
Anomalia Lunæ media	3	20	7			
Anomalia Lunæ æquata	3	21	5	*pro*	91	5
Argumentum Latitudinis medium	6	10	10	*pro*	109	10
Argument. Latit. verum	6	5	21	*pro*	185	51
Unde Latitudo Lunæ Auſtrina	0	0	28			

Ptolemæi *vero numeri hanc Eclipſin* 50 *fere minutis citius quam obſervatum eſt promittunt.*

Vides ex his numeris, quaſi tot errores quot veros reperiri, ideoq; haud levi ſtudio emendandos fuiſſe : ne, tamen correctionis nomine temere eos immutaſſe videar, Radices mediorum motuum Lunæ, Apogæi & Nodi, quales ipſe Albatenius *in his com-*

computationibus ſuppoſuit, adjungere placuit, ut cuilibet experiri liceat qua fide hæc obſervata tractavimus. Radices autem ſive Epochæ Lunarium motuum ab Æquinoctio, ineuntibus Annis Chriſti ſub Meridiano Arractenſi *ſic proveniunt.*

Annis Chriſti.	*Mot. Med.* ☽			*Apog.* ☽			*Nodus Aſc.* ☽		
	s	°	'	s	°	'	s	°	'
881	7	27	29	3	01	33	5	17	25
882	0	6	53	4	12	12½	4	28	5
883	4	16	16	5	22	52½	4	8	45
891	3	27	42	4	18	25	11	4	1
901	0	11	4	6	5	23	4	20	36

Multas etiam alias Eclipſes Lunares ſe obſervaſſe teſtatur Author, quas cum Tabulis ſuis congruentes invenit; adhibitâ maximâ in Syzygiis æquatione 5 gr. 1 min. qualem eam ſtatuit Ptolemæus, *ac qualem etiam hoc noſtro ſæculo Cœlo conformem experimur.*

Stellarum autem fixarum Loca duo tantum reperiuntur, ab hoc Authore ad ſuum ſeculum verificata; ad annum ſcil. Dhilcarnajin 1191 *ſive Annum* Chriſti 880: *Invenit autem* Cor Leonis *tunc temporis occupare gradum* 14°. 0′. Leonis; Boream *vero* frontis Scorpii ♏ 17°. 20′. *ſeu potius* 17°. 50′. *Aliter non conſtabit intervallum* 11°. 50′. *inter loca, ante* 783 *annos iiſdem à* Ptolemæo *tributa, & à ſeipſo obſervata, unde etiam ſtatuitur Stellas fixas ſingulis* 66 *annis gradum unum progredi, atq; una Solis* Apogæon. *Quod ſi revera ſcripſerit Locum hujus Stellæ* ♏ 17. 20. *ut habetur in libris impreſſis, majorem certe his obſervationibus fidem poſtulat, cum differentia locorum* Cordis ♌ *&* Boreæ frontis ♏, *certiſſimis noſtris obſervandi Methodis* 93°. 20′. *proveniat, ubi* Ptolemæi *Catalogus dimidio gradu abundat.* Albatênii *Cap.* LI.

Optaſſem quidem in aliqua ex inſtructiſſimis Europæ *Bibliothecis* Albatênii *exemplar* Arabicum *reperiri poſſe, unde has noſtras emendationes comprobare liceret; ac Linguam iſtam callentes exoratos velim, at hæc pauca ſaltem quæ obſervationes ſpectant, cum MSS conferre ac nobiſcum communicare non grave ducant. Non quod verear me errare poſſe in deducendis his numeris, fidiſſimis Aſtronomiæ principiis fretus; ſed quia Doctis quamplurimis, quibus fortaſſe Argumentum de immutato Tempore annuo non diſplicebit, harum emendationum ratio minime patebit, niſi hujus Scientiæ principiis imbuantur. Hic vero obiter notare licet Æram* Dhilcarnajin *à plurimis Chronologiſtis pro Æra Mortis* Alexandri *aſſumi, nominis ratione redditâ, quod* Alexander *vocaretur* Bicornis, *quaſi in Orientem ac Occidentem utrinque propagato Imperio. Æra autem noſtra duodecim annis Morte* Alexandri *poſterior eſt; unde liquet, non ad eum ſed ad ejus ſucceſſores Vocabulum iſtud referri.* Dhilcarnajin *autem proprie dicitur* Bicornis, *unde conjectura eſt hanc Æram inchoaſſe à bipartito Orientis Imperio inter* Antigonum & Ptolemæum, *quod ſub* Perſis *ac* Alexandro *diu indiviſum manſerat. Vel fortaſſe ab initio Regni* Seleuci Nicatoris *dicti, cujus Statuæ* Bicornes *fingebantur teſte* Appiano. *Idemque in* Numiſmatis *ejus etiamnum conſpicitur. Cornu autem paſſim pro Gloriâ ac Majeſtate etiam apud Sacras Literas reperitur. Incepere vero Anni hujus Æræ à Menſe* Elul *ſive Calendis* Septembribus Julianis, *cæterique Menſes* Julianis *ubique pares, ut ex his etiam obſervationibus conſtat.*

V. *An Account of the true* Cortex Winteranus, *and the Tree that bears it. By* Hans Sloan, *M. D. and S. R. S.*

ONE of the Ships which went out with Sir *Francis Drake*, when he went round the World, whereof Captain *Winter* was Commander, brought into *England* from the Straits of *Magellan* an Aromatic Bark, which had been very helpful to thoſe of his Ship, both uſed inſtead of other Spices, with their Meat, and as a Medicine very powerful againſt the Scurvy. *Cluſius*, from ſome that came over in that Ship, deſcribes and figures it in his *Exotics*, *lib.* 4. *c.* 1. *p.* 75. calling it, *Cortex Winteranus*, from the Commander of the Ship his Name, and the Tree *Magellanica Aromatica Arbor, ib. p.* 77. The Writer of the Journal of the *Dutch* Ships, that went to the Straits of *Magellan* about 1599. takes notice of it to grow there, calling it (*De Bry. Ind. Occid. p.* 9. *p.* 18.) *Lauro ſimilis arbor licet procerior, Cortice piperis modo acri, & mordenti.* And *Sebald de Wert*, who was there, ſays, that both Leaves and Bark were uſed with their Meat and Muskles, to correct them in ſo cold a Climate. *Dalechampius*, in the *Hiſtoria Lugd.* deſcribes and figures this Bark likewiſe, under the Name of *Cortex Winteranus, p.* 1858. and ſo does *Parkinſon, p.* 1652. *Caſpar Bauhin*, in his *Pin. p.* 461. calls it *Laurifolia Magellanica Cortice acri.* And *Jonſton*, in his *Dendrologia*, p. 232. *Arbor Laurifolia Magellanica.* Thoſe likewiſe who paſſed the *Magellanic* Straits with Sir *John Narborough* about 1669. took notice of this Tree and Bark. But no body that I have ſeen has given ſo good or full an Account of it as Mr. *George Handiſyd*, who came from thence about two or three

Years ſince, and being very Curious and Underſtanding in theſe Matters, did bring with him a Specimen or Sample of its Leaves and Flowers on the Twig, which is figur'd N°. 1. and its Seed, figured N°. 2. and likewiſe told me the ſeveral Particulars relating to it, in the following Deſcription, by which I cannot reduce it to any of our kind of Plants, ſo well as to the *Periclymenum*, and therefore ſhall call it, tho' it differs in many things from the Honyſuckle,

Periclymenum rectum foliis laurinis Cortice acri Aromatico.

He aſſured me that this Tree roſe to be higher and larger than an Apple-Tree, ſpreading very much both in Root and Branches. The Twigs had on them Leaves of a light-green colour on their upper ſide, ſtanding on ½ Inch-long foot-ſtalks, are an Inch and half long, and an Inch broad in the middle where broadeſt, and whence they decreaſe to both ends, ending blunt. The Flowers come *ex alis foliorum*, ſtanding on ¼ Inch-long foot-ſtalks, two, three, or more of them together, ſomething like thoſe of the *Periclymenum*; each of them are Milk-white, Pentapetalous, and ſmell like Jaſmine, to which ſucceeds an Oval Berry, made up of two, three, or more Acins or little Berries, ſtanding together on the ſame common foot-ſtalk, of a light-green colour with ſome black ſpots; and in theſe Berries are contained ſeveral black Aromatic Seeds, ſomething like the ſtones in Grapes.

It grows in the middle of the Straits of *Magellan* very plentifully.

The Leaves of this Tree were uſed with other Herbs by Mr. *Handiſyd* for Fomentations in ſeveral caſes with very good ſucceſs: But he admired moſt the uſe of the Bark inwardly, boyling half a Dram of it with ſome Carminative Seeds, and giving it ſo to thoſe of the Ship who were under his Care, very much afflicted with the Scurvy: It uſually ſweated them, and they were very much relieved. The ſame Medicine likewiſe he adminiſtred to a great many of the Ship, who were very ill by eating a poyſonous ſort of *Seal* in thoſe Parts, called a *Sea-Lion,* with which they had a very great Amendment, although they had been ſo ill with feeding on this Creature, as to looſe moſt of their skins, which peeled off their Bodies by degrees, and in large pieces; ſo that the Antidote to this ſtrange Poyſon was to be had very near it, and was very much extolled by this Gentleman, who was put to a ſtand to know what to do in this ſtrange caſe, although he very well underſtood the *Materia Medica.*

By the preceding Deſcription, and Figures relating to it, compared with thoſe of N°. 192. of theſe Tranſactions, it will very eaſily appear, that the *Cortex Winteranus,* commonly ſold in the Shops, is not the True *Cortex Winteranus.* But I muſt needs ſay, tho' they are the Barks of two very differing Trees, and growing in very differing places, and appear quite another thing in their outward face, yet their taſte is much the ſame, and I believe they may be uſed as a *Succedaneum* one for another, tho' if the true were to be had in plenty, it were much to be valued beyond the falſe, being much more Aromatic.

VI. *Pharma-*

VI. *Pharmacologia ſeu Manuductio ad Materiam Medicam in qua Medicamenta Officinalia Simplicia, hoc eſt Mineralia, Vegetabilia, Animalia eorúmque partes, in Medicina Officinis uſitata, in Methodum naturalem digeſta ſuccinctè & accurate deſcribuntur, cum notis generum Characteriſticis, Specierum Synonymis, differentiis & viribus. Opus omnibus Medicis, Philoſophis, Pharmacopœis, Chirurgis, & Pharmacopolis utiliſſimum.* A Samuele Dale.

THE uſe of the *Materia Medica* ſeems to be as old as Mankind, whoſe Infirmities ſpringing up early, call'd for Remedies, which Inſtinct or Neceſſity firſt dictated, afterwards Obſervation and Experiment improv'd. The *Ægyptians* inſcrib'd their Medicines on Pillars in the High-ways, and on the Walls of their Temples in great Cities, for the publick Inſtruction and Preſervation of the People. The *Greeks* taking their Rudiments from them, cultivated the *Medicinal Art*, which by the peculiar Fertility of their *Genius* was rais'd to ſuch a Perfection, that ſucceeding Ages being not able to continue its growth, ſuffered it to degenerate. The *Romans* (tho' extreamly civiliz'd) thought it Honour enough to Tranſcribe, or Epitomize the *Greeks*; *Scribonius Largus*, *Celſus*, and *Pliny* were only *Copiſts*. *Hippocrates*, *Ariſtotle*, *Theophraſtus*, *Dioſcorides*, &c. *Originals*; which *Galen* afterwards did indeed refine upon, but the *Latines* invented little or nothing. The *Arabians*, tho' very Luxurious in Fancy and Imagination, corrupted the *Greek* Purity ; ſo that the *Materia Medica* lay in great Diſorder and Obſcurity, till the Navigation to both *Indies* was detected and opened ; then the *Spaniards* and *Portugueſes* began to deſcribe the Phyſical Drugs bought up by the Merchants, but their Hiſtories are very lame and imperfect, and conſequently *Schroder*, who compos'd out of them : Since his time many *Officinals* have been fully illuſtrated in Print, and in Manuſcripts, both by the *Dutch* and *Engliſh*, out of which the Ingenious Author has compil'd the preſent Work in a moſt Natural, moſt Eaſie, and Perſpicuous Method, being aſſiſted by ſome learned Friends; ſo that very little (except a few Uſes) is taken from *Schroder* (as will appear by comparing them) the Body and Frame being altogether different, and the Diſcoveries of a later date; the whole Piece therefore may be juſtly eſteem'd new, and conſequently very Uſeful, being the Reſult of many Voyages and Itineraries to the Remote Parts of the World, and the Effect of many Admirable Obſervations daily made in the *Indian Colonies*.

The many Impoſtures and Cheats which the Dealers in *Drugs* and Phyſical *Herbs* do daily commit, gave occaſion to our Author of Publiſhing this ſmall Tract, in which, after having given an Explication of divers of the Terms of Art uſed among *Mineralogiſts*, *Botaniſts*, and *Zoologiſts*, and a ſhort Deſcription of moſt of the *Utenſils* of the *Apothecary*'s and *Chymiſt*'s Shops, he doth premiſe ſomething in General concerning the Collection, Duration, Time, Manner, and Place of Preſerving *Simples*, together with their Vertues, Uſes, and Chymical *Analyſis*, with a ſhort Account of the General Diviſion or Method of the Book.

Theſe being premiſed, our Author proceeds to the Work it ſelf, which he divideth into four Books: The firſt of which Treats of *Minerals*, and contains ſix *Sections*. The firſt concerning *Waters*, which are either

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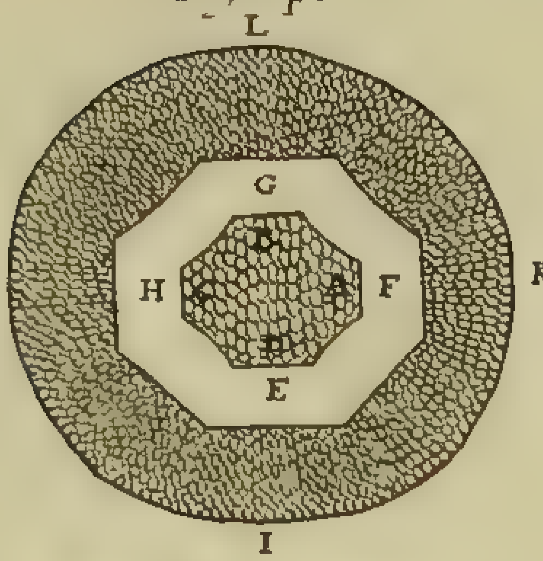
Philosophical Transactions Numb. 205

Fig: 4.



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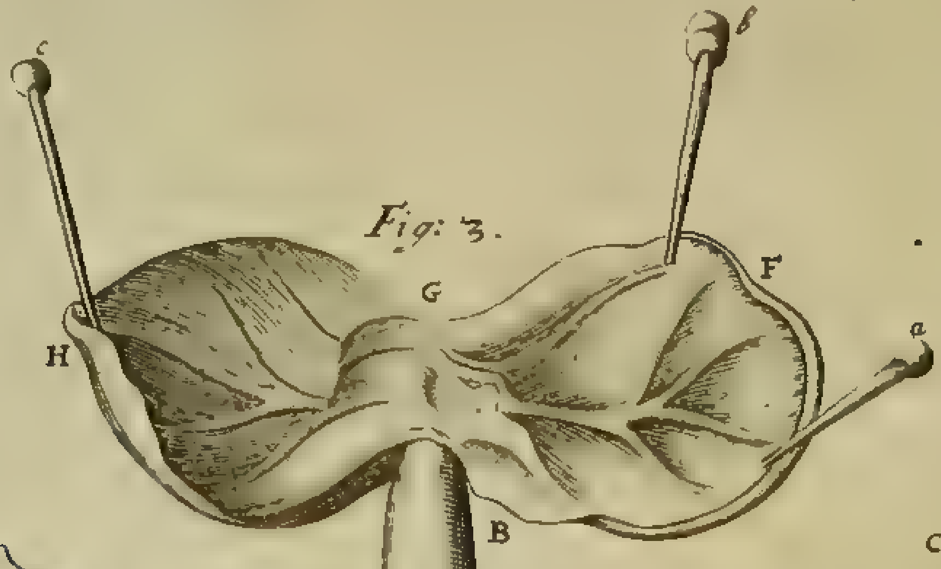


Fig: 1.

Fig: 2.

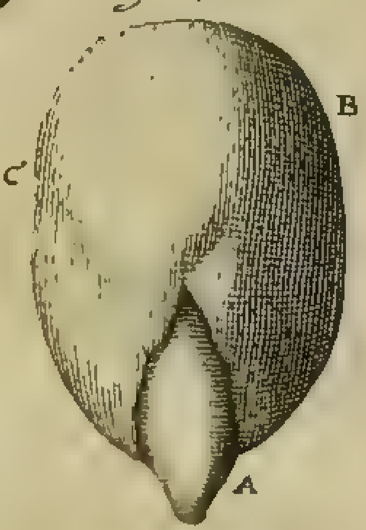


Fig: 8.

Fig: 7.

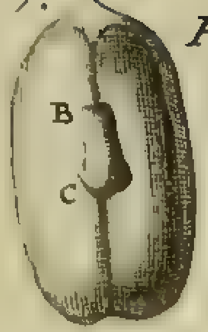
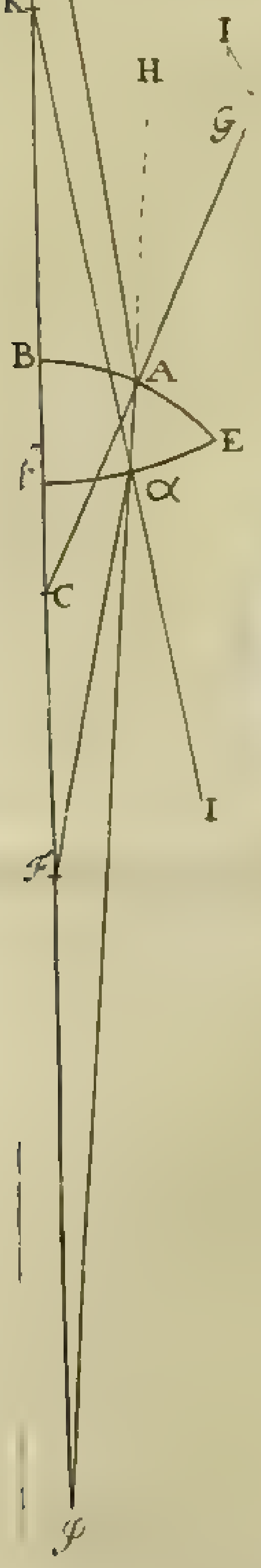


Fig: 6.

Fig: 5.

Fig: 18.



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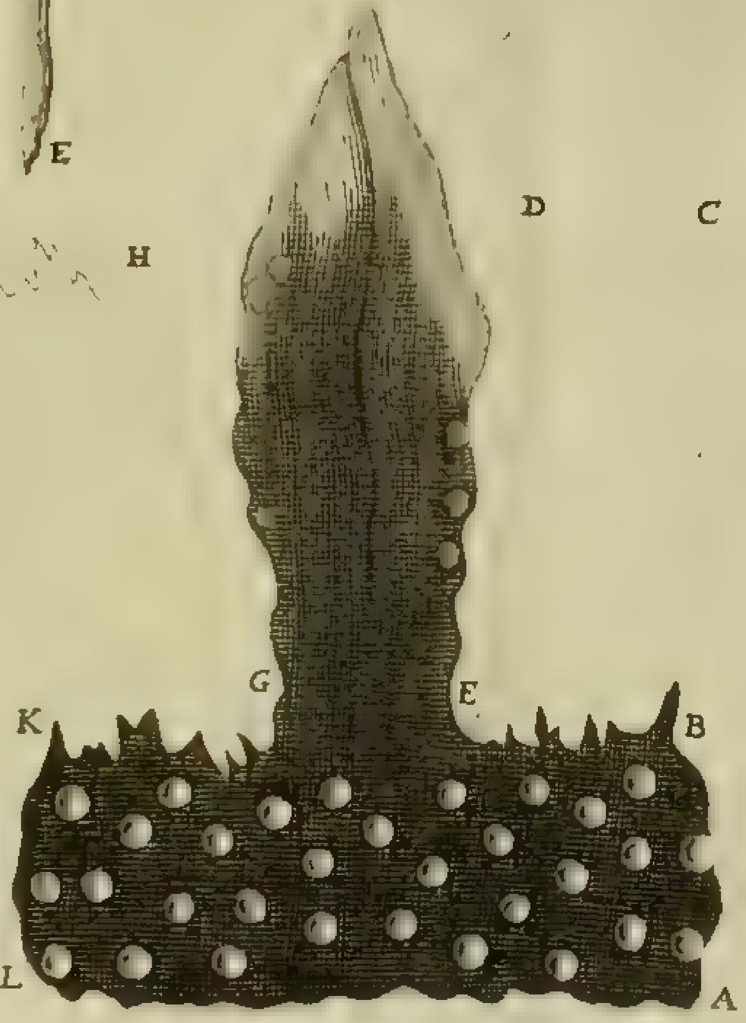


Fig: 10.

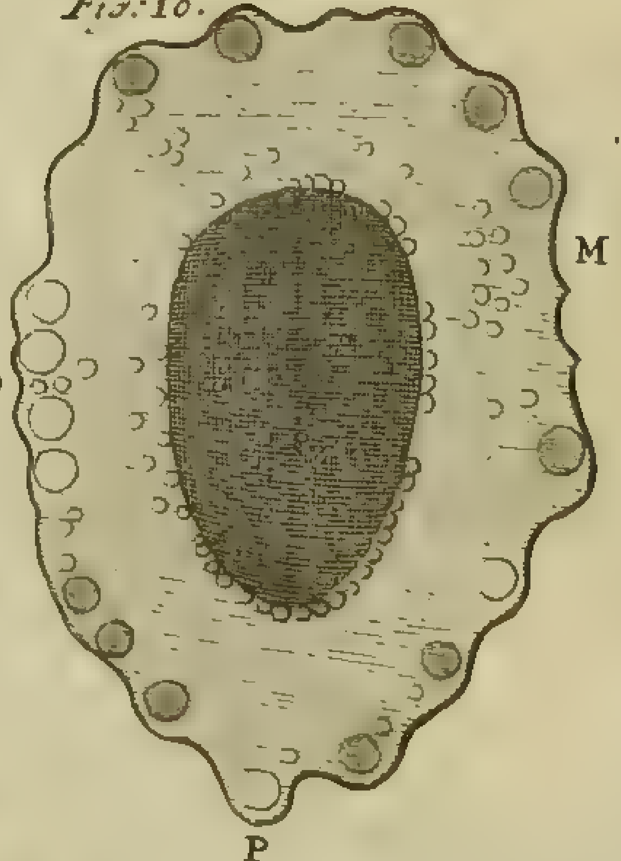


Fig: B.

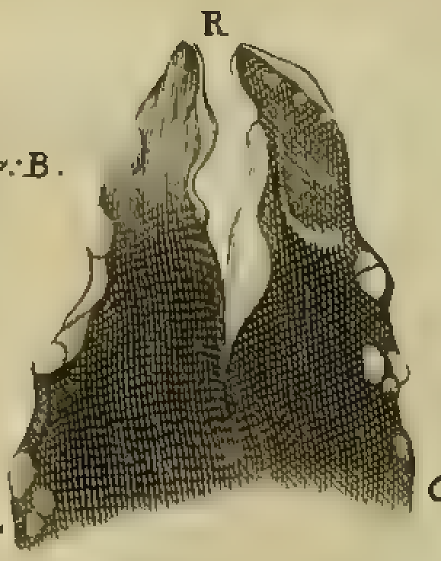


Fig: 12.

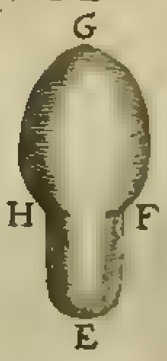


Fig: 11.

Fig: 14.

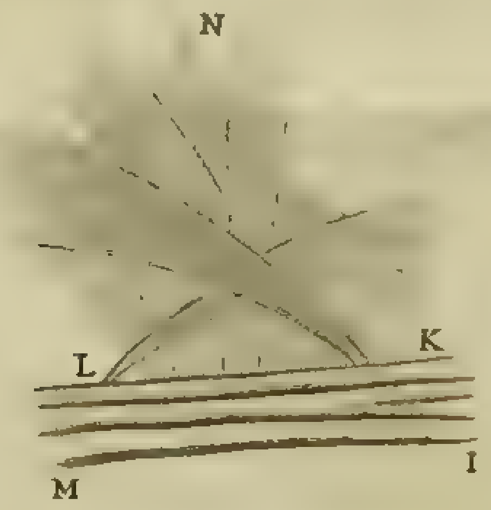
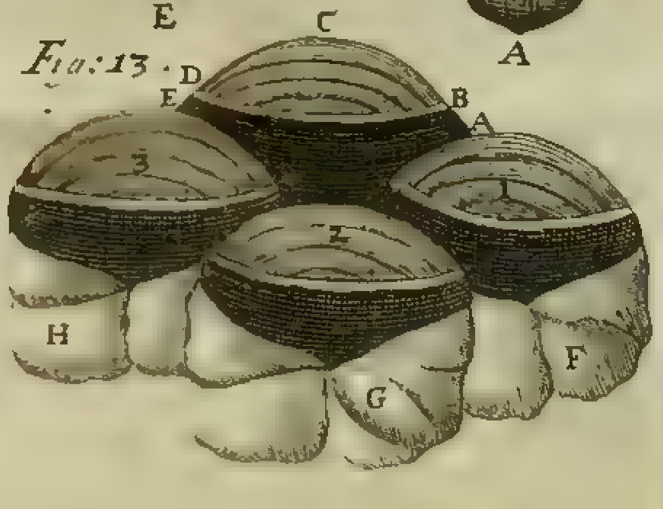


Fig: 13.



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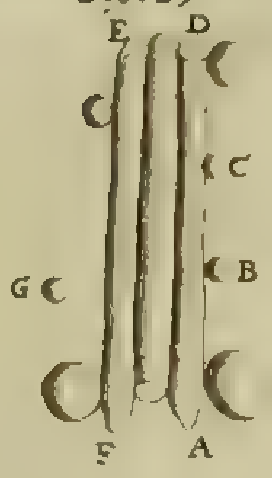
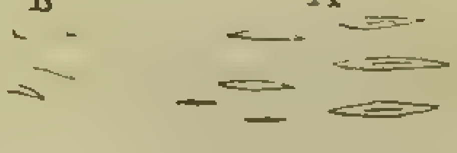


N° 16.

N° 15.



Simple or Mineral. Secondly, *Earths*, and they are of four ſorts, *Boles*, *Clays*, *Marles*, and *Chalks*. The Third Section is of *Sulphurs*, *Arſnicks*, and *Bitumens*. The Fourth treats of *Salts*, as *Sal communis*, *Sal Gemmæ*, *Nitrum*, *Alumen*, *Borax*, and *Vitriolum*. The Fifth contains *Metallick Foſſils*, which are divided either into *Oars*, as the *Cinnabaris*, *Hæmatitis*, &c. or *Baſtard Metals*, as *Antimonium*; or *Perfect Metals*, as *Argentum*, *Plumbum*, *Cuprum*, &c. The Sixth and laſt Section is of *Stones*, which are either ſuch as are not Precious, as *Lapis Calaminaris*, *Hybernicus*, &c. Or Precious, and they are either Opake or Diaphanous, which are generally called *Gems*.

The Second Book treats of *Plants*, and is divided into three *Claſſes*; the firſt of which is of ſuch Plants as are of a ſtony Subſtance, as *Corallium* and *Corallina*.

The Second Claſs is of *Herbs*, and is divided into 25 Sections, in which our Author for the moſt part following the Method of that moſt Ingenious Botaniſt, the Learned and Judicious Mr. *John Ray*, in his Excellent *Hiſtoria Plantarum*, of which a large Account as to its Diviſions, *&c.* having already been publiſhed in theſe *Tranſactions*, N°. 186. *pag.* 283. I ſhall in this place ſay no more, but ſhall refer the Curious thither.

The Third and laſt Claſs of this Second Book is of *Trees* and *Shrubs*, and contains 11 Sections. The firſt of which is of ſuch Trees as have a ſingle ſtem without any Branches, and produce but one Bud, as the *Palma*. Then our Author proceeds to ſuch Trees and Shrubs as are branched, or have Boughs and Twigs; and in the ſecond Section treats of ſuch as have their Fruit disjunct from their Flower, and they are either *Nuciferous*, as the *Juglans*, and *Corylus*: Or *Glandiferous*, as the *Caſtanea*, *Quercus*, &c. Or *Coniferous*, as the *Abies*, *Sabina*, &c. Or *Bacciferous*, as the *Juniperus*.

Or

Or Laſtly, *Lanigerous*, as the *Populus* and *Salix*. After theſe he comes to treat of ſuch Trees and Shrubs as have their Flower and Fruit contiguous. And in the Third Section, of ſuch Trees and Shrubs whoſe Flower and Fruit are *Aggregate*, as the *Ficus*, *Morus*, *Piper Longum*, and *Liquid Amber*. The Fourth Section contains ſuch Trees and Shrubs as have an *Umbilicated* Fruit; that is, ſuch whoſe Flower ſtands upon the top of the Fruit, the *Calyx* whereof makes a ſort of *Umbell*; and they are either *Pomiferous*, as the *Malus*, *Pyrus*, *Granatus*, &c. or *Bacciferous*, as the *Ribes*, *Myrtus*, *Caryophyllus*, *Cortex Winteranus*, &c. He then proceeds to ſuch Trees and Shrubs as have their Flower at the bottom of the Fruit. And in the Fifth Section comprehends ſuch which have the *Calyx* of their Flower *non deciduous*, in which the Fruit ſtandeth as in a Cup, and theſe he calls *Calyculated* Fruits; as the *Sebeſtena*, *Agnus Caſtus*, *Saſſafras*, *Cinnamomum*, *Camphora*, *Styrax*, and *Canella alba*. Theſe being diſpatch'd, our Author comes to treat of ſuch Trees and Shrubs which have their Flowers and the *Calyx's* thereof *diciduous* together. And in the Sixth Section begins with the *Pruniferous*, that is, ſuch as have a large Fruit covered with a tender Skin, containing one large ſtone within a Juicy Pulp, eſpecially when ripe, as the *Prunus*, *Ceraſus*, &c. The Seventh Section comprehends the *Bacciferous* Trees and Shrubs, that is, ſuch whoſe ſmaller Fruit doth contain in a Pulpy Juice one, two, three, four, or many Seeds: Thoſe with but one Seed or Stone, are the *Balſamum*, *Terebinthus*, *Cububæ*, *Coculus Judus*, &c. Thoſe with two Seeds are *Jaſminum*, *Liguſtrum*, *Berberis*, &c. With three Seeds the *Sambucus*. With four, the *Vitis*, *Thea*, *Agrifolium*, &c. Laſtly, with many Seeds, the *Rubus*, &c. The Eighth Section contains the *Pomiferous* Trees and Shrubs, and theſe are all *Polypyrene*, and they are either ſuch as have a fleſhy and tender Rind or Peel, as the *Aurantia*, *Citrus*, *Cambogium*, &c. Or ſuch as have their Pulp contained in a hard ſhell, as the *Nux Vomica* and *Cacao*. The Ninth Section treats of ſuch Trees and Shrubs whoſe Fruit when ripe is dry, as the *Laurus*, *Coffee*, *Piper rotundum*, *Guajacum*, *Ulmus*, *Fraxinus*, &c. The Tenth Section comprehends the *Siliquoſe* Trees and Shrubs, and they are either ſuch as have a *Uniform* Flower, as *Senna*, *Glans Unguentaria*, *Caſſia Fiſtula*, *Tamarindus*, &c. or ſuch as have a *difform* or *Papilionaceous* Flower, as the *Geniſta*, *Acacia*, *Caroba*, *Braſilia*, &c. The Eleventh and laſt Section of this Book is of ſome parts of Plants which are of uſe in the *Shops*, which becauſe for want of a good Account thereof they could not be reduced to the foregoing Method, are therefore ranged either as *Roots*, as the *Rhodium*, or *Barks*, as the *Cortex Thuris*; or *Woods*, as *Lignum Aloes*, &c. Or, laſtly, *Gums*, as the *Olibanum*, *Bdellium*, and *Cancamum*.

The Third Book contains *Animals*, which by our Author is divided into two *Claſſes*, and in the firſt treats of *Exanguious Animals*, which are divided into two Sections, in the firſt of which he comprehends *Inſects*, which are either *Apoda*, as the *Sanguiſuga* and *Lumbricus Terreſtris*, or *Pedata*, which are either *Non Alata*, as the *Pediculus*, *Ricinus*, *Scorpio*, *Millepedes*, &c. or *Alata*, and they are eitheir *Anelytra*, as the *Muſca*, *Apes*, *Formica*, *Cicada*, *Bombix*, &c. or *Coleoptera*, which are either *Scarabæi*, as *Cantharides*, *Cochinilia*, &c. or the *Cicindela*; or laſtly, the *Proſcarabæus*. The Second Section contains the greater *Exanguious Animals*, which are either *Mollia*, as the *Sepia*: or *Teſtacea*, which are either *Univalvia*, as the *Dentalium* and *Entalium*; or *Turbinata*, as the *Cochlea*, *Blatta Byzantina*, *Buccinum*, and *Purpura* : or *Bivalvia*, as the *Oſtreum*, *Mater Perlarum*, *Unguis Odoratus*, &c. Or, laſtly, *Cruſtacea*, as the *Aſtacus fluviatilis*, *Cancer Marinus*, &c.

The Second Claſs is of *Sanguineous Animals*, and is divided into Four Sections; and in the firſt our Author treats of *Fiſhes*, and begins with ſuch as are *Auguilliform*, or which have ſlender ſmooth Bodies without *Scales*, or at leaſt very ſmall ones, as the *Auguilla*, *Muſtela*, and *Lupus Marinus*: He then deſcends to ſuch as have a more contracted Body, and thoſe are either *Marine*, having but one *Fin* on their backs, whoſe *Rays* are not *Aculeate*, as the *Harengus*, *Encraſicholus*, *Sturio*, and *Ichthyocolla*. Secondly, ſuch as are *Fluviatile* with but one *non aculeate Fin* on their backs, having *Teeth* in their Mouths, as the *Lucius*. Thirdly, *Fluviatile* Fiſhes as aforeſaid, but without *Teeth*, as the *Cyprinus*, *Tinca*, and *Barbus*. Fourthly, *Fiſhes* which have two *non aculeate Fins* on their backs, as the *Thymallus* and *Trutta*. Fifthly, ſuch as have two *Fins* on their backs *aculeate*, as the *Perca* and *Mugil*. Sixthly, *Cartilagineous Fiſhes*, as the *Galeus acanthias*. Sevently, and laſtly, *Cetaceous Fiſhes*, as the *Monoceros*, *Orca*, and *Balæna*.

The Second Section contains *Birds*, and they are either *Aquatick* or *Terreſtrial*; the *Aquatick* are of two ſorts, Firſt, *Fiſſipedes*, as the *Grus*, *Ardea*, and *Ciconia*. Secondly, *Palmides*, as the *Cygnus*, *Anſer*, and *Anas*. The *Terreſtrial* are either *Majores* or *Minores*. The *Minores* are again divided according to their Bills, into, Firſt, ſuch as have *Long-Bills*, as the *Iſpida*. Secondly, ſuch as have ſlender or ſoft *Beaks* or Bills, as the *Alauda*, *Hirundo*, *Paſſer troglodytes*, &c. Thirdly, ſuch as have hard *Beaks* or Bills, as the *Paſſer vulgaris*. The *Majores* are likewiſe divided into three ſorts: As Firſt, ſuch as have thick, ſtrong, and longiſh Bills, as the *Corvus*, *Pica*, &c. Secondly, ſuch as have ſhorter and leſſer Bills, as the *Gallinaceous* and *Columbaceous* kinds. And laſtly, into thoſe which have crooked *Beaks* or Bills, as the *Aquila*, *Vultur*, &c.

In the Third Section is comprehended the *Serpentine* kind, and they are either *Apoda*, as the *Serpens* and *Vipera*; or *Pedata*, which are either *Caudata*, as the *Lacertus*, *Scincus*, &c. or *non caudata*, as the *Rana* and *Bufo*.

The Fourth and Laſt Section is of *Quadrupedes*, which are divided into *Ungulata* and *Unguiculata*. The *Ungulata* are of three ſorts (*viz*) Firſt, *Solidungula*, as the *Equus*, *Aſinus*, &c. Secondly, *Biſulca*, which are either *Ruminantia*, as the *Bovinum genus*, *Ovis*, and the *Caprinum* and *Cervinum genera*: Or *Non Ruminantia*, as the *Porcus* and *Aper*. Or Laſtly, *Quadriſulca*, as the *Rhinoceros* and *Animal Moſchiferum*. The *Unguiculate* are the *Elephas*, *Equus Marinus*, *Lepus*, *Caſtor*, *Urſus*, *Animal Zibethicum*, &c.

The Fourth and laſt Book is the *Anthropologia*, in which the Parts of a *Humane* Body which are of uſe in the *Shops* are enumerated; and theſe are divided into two *Sections*, and in the firſt are contained thoſe which are taken from a Living *Body*. And Secondly, ſuch as are taken from a Dead *Body*.

And Laſtly, is added a ſmall *Appendix* of ſome very few things omitted in the Work.

Having run over the General *Method* and *Diviſion* of the Work, I ſhall deſcend to the particular Method thereof, which is this: At the beginning of each Book you have a General *Scheme*, or *Philoſophick* Table of all the Heads or Sections in that Book: Likewiſe at the beginning of each ſubſequent Section you have a particular *Scheme* of all the Heads in that Section. Each Section doth likewiſe contain ſo many Chapters as there are diſtinct Heads: In each of which *Chapters* you have, firſt, the *Characteriſtick* Note, whereby it may be diſtinguiſhed from others, which are chiefly taken from the Extant Works of that great and learned Enquirer into Nature, Mr. *John Ray.* Secondly, you have the Names of each thing in *Latine* and *Engliſh*, not only how it's called in the *Shops*, but by the lateſt and moſt *Claſſick* Authors. Thirdly, you have the Place where each thing is Naturally to be found, and in the *Herbs* the time of flouriſhing. Fourthly, you have an Account of what parts of each are uſed in the *Shops*, with ſhort, but pertinent *Deſcriptions* thereof. And Fifthly, you have a *Compendious* Account of their *Vertues* and *Phyſical* Uſes, which are chiefly excerpted from the learned *Schroder.* After which you have frequently many Uſeful and Curious *Obſervations*, ſome few of which I ſhall briefly preſent you with according to the Order of the *Books*, and for the reſt refer you to the Work it ſelf.

In the Firſt Book, treating of *Earths*, our Author takes notice of Nine ſorts of ſealed *Earths*, which he hath obſerved to be ſold by the Drugiſts of *London*, under the Title of *Terra Sigillata*, and doth not doubt but many more may be found among them. Among *Sulphurs* he obſerves, that if *Orpiment* be the Natural *Oar* of *Gold*, as ſome affirm, then that *Metal* cannot have thoſe *Alexipharmick* and *Cardial* Vertues that are aſcribed to it by *Authors*. *Amber* and *Amber-griſe* he takes to be *Mineral* Juices, and therefore rangeth them among *Bitumens*. Among the *Salts*, he obſerves that our Modern *Nitre* is a *Foſſil* Salt, differing from the *Nitre* of the *Ancients*; and that *Vitriol* is not properly a *Salt*, but a Cryſtallized *Metal*. And concerning *Stones*, eſpecially *Gems*, he doth believe that there are many things affirmed concerning them by Authors, which are either Fabulous, Doubtful, or at leaſt Superſtitious.

In the Second Book he takes notice that the true *Rubarb* is not a *Dock*, but the Root of a Plant with a *Pentapetalous* Flower; and that the *Rhabarbarum* of *Alpinus*, which in our Gardens is called *Rubarb*, is the true *Rupontick*, which ought to be uſed in the *Shops* inſtead of the Root of a *Centaurium Majus*, which is frequently ſold for it. Concerning the *Been album & rubrum*, he enumerates the many Controverſies among Authors, both Ancient and Modern, and the *Root* of what Plant each would have it to be; and concludes, that if the *Papaver Spumeum* is not the *Been album*, and the *Limonium* the *Been rubrum*, which by reaſon of the imperfect Deſcriptions of the *Arabians*, he dares not aver, yet may they not improperly be uſed as their *Succedaneums*. *Contra-yerva* is the Root of a *Pomiferous* Herb; as are *China* and *Sarſaparilla* of *Bacciferous*: *Jalapium*, *Mechoacanna* and *Turpethum* are the *Roots* of divers Species of *Convolvuli*: *Opium* he proves to be the Concret Spontaneous Juice of a *Poppy*. He excellently proves the *Amomum verum* to be a ſort of *Cardamomum*, as is alſo the *Malegneta*, or *Grana Paradiſi*: Unto which Tribe alſo belongs the *Curcuma*, *Coſtus*, *Galanga*, *Zedoaria*, *Zerumbeth*, and *Zinziber*. *Nardus Indica* he makes the Root of a *Cyperus*.

Among Trees and Shrubs he demonſtrates *Terra Japonica* not to be an *Earth*, but the condenſed Juice of the Fruit of the *Fauſel*; *Balſamum è Toly* the *Reſine* of an *American Pine*. *Cocculus Indus*, and *Nux Vomica*, are, the one of a *Bacciferous*, and the other of a *Pomiferous Aſafœtida*: *Benzoin*, *Cambogium*, *Caranna*, and *Tacamahaca*, &c. by what Trees they are produced. The *Cortex Winteranus* he proves not to be the *Canella Alba* which is ſold for it in the Shops, but the Bark of another Tree with an Umbilicated Fruit growing in *Magellan*. *Manna* and *Gum Lacca* he clearly ſhews to be Spontaneous *Exudations*; the firſt of the *Fraxinus*, and the other of the *Jujuba Indica*, and that by many undeniable Arguments.

In the Third Book he ſhews you what the *Cochinella* is, with many excellent Obſervations thereon. The *Blatta Byzantina* he proves to be an *Operculum* of a *Turbinated* Shell-fiſh, different from the *Vnguis Odoratus* of *Dioſcorides*, which he takes to be a ſort of *Conchylium* or *Bivalve*. *Pearls* he affirms to be only the Diſeaſes of *Bivalve* Shell-fiſh, and therefore doth not think them endued with thoſe excellent *Vertues* aſcribed to them by moſt Authors. He clears up what the *Dentalium*, *Entalium*, *Purpura*, &c. are. Among *Fiſhes*, he Obſerves that the *Lapides Bufonites* are the *Teeth* of the *Lupus Marinus*; and that the *Vnicorn*'s Horn of the *Shops* is not the Horn of a *Quadrupede* like a Horſe, as ſome feign, but the *Tooth* of a *Fiſh* of the *Cetaceous kind*; he reckons up the many Opinions about *Sperma Ceti*, and affirms it to be an Unctuous Matter to be found in the Brain of a ſort of *Whale*, and ſolves the Reaſon of its being found floating upon the Sea, as well as in its Natural place. In the Section of *Quadrupedes* our Author well obſerves the *Bezoar* to be a Stone, generated, or rather encruſted about divers things in the *Ventricles* or *Stomacks* of *Animals*, and is of divers ſorts; as *Oriental*, found in a ſort of *Goat*, the *Occidental* in an *American Deer*, and the *German* in a ſort of *Goat*. Concerning the *Rhinoceros*, he is of Opinion, that he is the only *Vnicorn* to be found among *Quadrupedes*, and perhaps may be the true *Vnicorn* of the Ancients, whoſe Horn *Ælianus* affirms to be black, which Conjecture *Andreas Baccius* doth confirm. *Musk* he takes to be an *Excrementitious* Blood, ſecreted in its proper *Cyſtis* near the *Navil* of a *Quadriſulc Animal* like a *Deer*. *Civet* he affirms to be an *Excrementitious Succus*, by Nature ſecreted in its proper *Follicule* near the *Anus* of an *Animal* of the *Dog-kind*, and not the *Sperm*, as ſome have aſſerted. *Caſtor* he proves to be the *Scent-bags* adjoyning to the *Inteſtinum Rectum*, and not the *Teſticles* of the *Beaver*, as ſome aſſert.

In the Fourth and laſt Book our Author takes notice, that the *Sal Armoniac* of the Shops is a factious *Salt* made of *Human Urine*, *Soot*, and *common Salt*, and is not that of the *Ancients*, which *Pliny* and others affirm to be found among the Sands of *Lybia*. And laſtly, Obſerves that *Mumia* is of four ſorts; all which he doth demonſtrate. And here I ſhall finiſh my Account, recommending to thoſe which deſire further Satisfaction in the *Materia Medica* the Book it ſelf, which is of excellent Uſe to all *Phyſicians*, *Philoſophers*, *Apothecaries*, *Chirurgions*, and *Drugſters*.

Advertiſements.

THE Reader is deſired to Correct a Miſtake in *Philoſophical Tranſactions*, Numb. 202. p. 824. The *Truffles* there mentioned being diſcovered at *Ruſhton* in *Northampton-ſhire*, by the Learned Phyſician Dr. *Hatton* of *Harborough* in *Leiceſter-ſhire*.

Libri quidam novi qui proſtant apud S. Smith, & B. Walford, *ad inſignia Principis in Cœmiterio* D. Pauli, *Acta Eruditorum ab Anno* 1682. *ad* 1692. *incluſivè cum tredecem Supplimentis.*

Indices Generales Actorum & Rerum primi Actorum Eruditorum quæ Lipſiæ *publicantur Decennii nec non Supplimentorum Tomi primi.*

Geneſis *ſive* Moſis *Prophetæ Liber primus, Tranſlatione* Joannis Clerici, *cum ejuſdem Paraphraſi perpetua, Commentario Philologico Diſſertationibus Criticis quinque, & Tabulis Chronologicis.* Amſt. 1693. *Fol.*

Reliqui Moſis *Libri quatuor ſub prælo ſudant, totum opus in omnes veteris & Novi Teſtamenti Libros cum Paraphraſi & Commentario ejuſdem Authoris in ſex Tomis prodibit.*

Wilhelmi Erneſti Tentzelii *Exercitationes ſelectæ in Duas Partes diſtributæ: Quarum Priori præter Symbolum Apoſtolicum,* Clementis Romani, Ignatii, Polycarpi, Juſtini Martyris, Athenagoræ, Theophili, Antiocheni, Tatiani, Hermiæ, Jacobi Niſibenſis, & Ephremi Syri, *Scripta expenduntur, plerorumque vita præmiſſa; Tum* Conſtantini *Magni Baptiſmus, Natalitia Epiſcoporum, Hymnuſque, Te Deum Laudamus, illuſtrantur: Poſteriori, Diſciplina Arcani in Apricum producitur, aliaque Antiquitatis Eccleſiaſticæ Capita explicantur cum Indicibus.* Quarto. 1693.

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PHILOSOPHICAL TRANSACTIONS.

For the Month of November, 1693.

The CONTENTS.

I. *AN Extract of a Letter from Sir* Rich. Bulkley, *S.R.S. to Dr.* Liſter, *concerning the Improvement to be made by the Cultivation of* Maize *in* Ireland; *with a Remark thereon, by Mr.* John Ray, *S.R.S.* II. *A Letter from Mr.* John Clayton, *Rector of* Crofton *in* Yorkſhire; *being a Continuation of his Account of* Virginia, *touching the Earth and Soyl thereof; with ſome Obſervations on the Planting of* Tobacco, *promiſed in* Tranſact. *Numb.* 201. III. *An Extract of a Letter from Mr.* Anth. Van Leeuwenhoek, *S.R.S. to the* Royal Society, *containing his Obſervations on the Seeds of* Cotton, Dates, Cloves, Currans, Gooſeberries, *&c. the Scales of* Fiſh, Pores *of the Skin, Salts in ſeveral Liquors,* &c. IV. *An Inſtance of the Excellence of the Modern* Algebra, *in the Reſolution of the Problem of finding the* Foci *of Optick Glaſſes univerſally, by Mr.* E. Halley, *S.R.S.* V. *An Abſtract of part of a Letter from Mr.* Samuel Dale, *to Mr.* John Haughton, *S.R.S. concerning the making of* Turnep-bread, *in* Eſſex. VI. *An Extract of a Second Letter from Sir* R. B. *concerning the Propagation of Elms by the Seed.* VII. *An Account of a Book entituled,* Phalæinologia nova ſive Obſervationes de Rarioribus quibuſdam Balænis in Scotiæ Littus nuper ejectis, *&c, Auth.* Roberto Sibbald. Edinburgi *in* 4° 1692.

I. *The Extract of a Letter from Sir* Richard Bulkley, *S. R. S. to Dr.* Liſter, *concerning the Improvement to be made by* Maize; *with a Note on the ſame by* John Ray, *S.R.S.*

Vid. Philoſ. Tranſact. Numb. 142

MY long Silence has only proceeded from my deſire of having Matter worthy the communicating to you, which it was neceſſary for me to expect; I mean the Harveſt of my *Maiz*, which notwithſtanding that I ſow'd it ſix Weeks later than I ought to have done, yet is it now, what is ripe, of ſo great profit, that it may, I verily believe, render uſeleſs the Cultivation of the Field White Pea, (to which Grain it is the moſt like in Taſte and Figure). The greateſt Profit that ever I have heard of White Peaſe, has been twenty Barrels reap'd for one ſown; but this, I am ſure, had I ſown it in the middle of *April*, (whereas I ſow'd it not 'till the end of *May*) it would have yielded me 1920 for one, perhaps twice or thrice ſo many for one, as you may judge by the following Computation: The *Grappe* I uſed for Seed, grew in *Brandenburg*, and it, and the reſt that I did not yet ſow, had eight Sides or Rows of Grain, each of which Rows has thirty Grains (perhaps, in its own Country, it may have more in a Row) ſo that each ripe *Grappe* has 240 Grains. I made Experiment with one of theſe in good Orchard Ground, (which had been indeed dung'd for ſome other Legumes the laſt Year) and ſow'd them in Rows, each Row about a Yard aſunder, and each Grain about a Foot aſunder in the Row, taking care to preſerve them from the Mice 'till above Ground. Now out of each Grain came up 3, 4, 5, or 6 Stems, (my *Suiß* ſays, he rarely has ſeen above two or three elſewhere) every of which Stems had four, three, or two of theſe *Grappes*. Now theſe Grains ripening gradually, that is thoſe Grains firſt, which are neareſt the Stem , many of my *Grappes* have the Grains neareſt the extremity or pointed end, but half or three quarters ripe ; but, it may be, as far as the 15th or 16th, and in ſome to the 20th Grain from the Butt-end are quite ripe. So then, if you will for your fancy compute, what would certainly have been, had I ſow'd them in time,that each Grain give but three ſtrong Stems, (and let the reſt be cut off) and each of theſe Stems three *Grappes* (but ſome of them never fail of four) and each *Grappe* 240 Grains, that makes 2160 for one : Profit enough of all Conſcience. But there are ſome things very odd in the manner of its growth, to thoſe who have not cultivated it, of which you will pardon me the recital. It firſt ſends up a thick reedy Stalk about a Yard high, with long Leaves of a very thick woody ſubſtance, and half a Yard long enwrapping the Stalk juſt like the *Iris.* At the top of this Stalk, when the Leaves open, there appears twenty or thirty Ears, as it were, of our unripe Wheat ; but this, when it is opened, muſt be plucked away, for it is nothing but the Flower ; and what is moſt ſurpriſing, the Fruit comes not where the Flower was, but on the inner-ſide of every Leaf, where it joyns to the ſtem, comes forth after a time, a large ſhoot, thicker than ones Wriſt, at the end of which hangs out a bundle of fine ſtrings, like a Horſe-tail, which is the true Flower of the Plant : as this withers, the Fruit grows on within, being envelop'd in a great number of Leaves, which when they are withered, the Fruit is ripe, (but is never naked while on the ſtalks) and muſt then be taken off, and hung up to dry, or kept in Cheſts. It will ſerve for all the Uſes of the White Pea, either in Bread (with Wheat) or Soupe, or Pudding, or with Pork. I reckon that eight or ten *Grappes* of it ſown the next Year, will furniſh me, God willing, with ſome Barrels of it. It muſt be earth'd up with the Howe twice or thrice in growing.

I am not yet ready to give you an Account of the *Hy-*

metto Bee-hives, tho' I have receiv'd great Inſtruction from them, nor ſhall venture to do it, 'till another Year's Experience of the propagating of them. I am quite diſcouraged as to making a Vineyard: for the Vines of this Country burſt the Grape, and render to no purpoſe our Endeavours, having great Winds, and little Sun, *&c.*

Your affectionate humble Servant,

R. Bulkely.

Mr *Ray*'s Note on the *former Letter* concerning the *Maize.*

I *Have not much to ſay: He hath made a commendable Eſſay; but whether it will turn to Account to plant* Maize *in* Ireland, *I think there is ſome reaſon to doubt: If it be equal in goodneſs to Peaſe, and an Acre planted with it will certainly yield more than one ſown with Peaſe, without impoveriſhing the Land, then indeed it will be advantageous to plant it: but if only an equal quantity, then tho' one Grain ſhould yield a thouſand-fold, all the advantage will be in the difference of the Seed, which is not very conſiderable, and which the Compendium of Sowing above Setting may in ſome meaſure countervail. As for the Deſcription of the Plant, all the Parts of it have been ſo particularly and exactly deſcribed in* Engliſh *as well as* Latin, *that I think it needleſs to publiſh a new Deſcription; only I am by this Deſcription confirmed in my Opinion, That there are two really diſtinct Species of* Maiz: *for what I have ſeen cultivated in Gardens, and have my ſelf planted, ariſeth to double the ſtature he aſcribes to this, that is* 7, 8, *or* 10 *Feet; and beſides, with us, never brings the Seed near to perfection: but that I have ſeen planted in the Fields in* Germany, *is of about the ſame height with Sir* Richard's, *and ripens the Seed.* Lobel *alſo acknowledges two ſorts thus differing.*

II. *A Continuation of M^r* John Clayton*'s Account of* Virginia.

Vid. *Philoſ. Tranſact.* Numb. 201.

Of the EARTH *and* SOYL.

WHen you make the Capes of *Virginia*, you may obſerve it low Land, ſo that at ſome diſtance the Trees appear as if they grew in the Water; and as you approach nigher, to emerge thence. For a hundred Miles up into the Country, there are few Stones to be found, only in ſome places, Rocks of Iron Oar appear, which made me expect to have found many Waters turn Purple with Galls, but never met with any. Providence has ſupplied the common uſe of Stones, by making the Roads very good: ſo that they ride their Horſes without ſhooing them; which yet are more rarely beaten on their Feet, than ours are in *England*, the Country and Clime being dry, their Hoofs are much harder: for I obſerved, that take a Horſe out of the wet Marſhes, and Swamps, as they there call them, and ride him immediately, and he'll quickly be tender-footed. In ſome places, for ſeveral Miles together, the Earth is ſo intermix'd with Oyſter-ſhells, that there may ſeem as many Shells as Earth; and how deep they lie thus intermingled, I think, is not yet known: for at broken Banks they diſcover themſelves to be continued many Yards perpendicular. In ſeveral places theſe Shells are much cloſer, and being petrefied, ſeem to make a Vein of a Rock. I have ſeen in ſeveral places, Veins of theſe Rocky Shells, three or four Yards thick, at the foot of a Hill, whoſe Precipice might be twenty Yards perpendicular, whoſe Delf, I ſuppoſe, ſhot under the Hill, pieces of theſe Rocks broken off, lie there, which, I ſuppoſe, may weigh twenty or thirty Tuns a piece, and are as difficult to be broken as our Free-ſtone. Of theſe Rocks of Oyſter-ſhells that are not ſo much petrefied, they burn and make all their Lime; whereof they have that ſtore, that no Generation will conſume. Whether theſe were formerly Oyſters, which left by the ſubſiding Seas, (as ſome ſuppoſe, that all that Tract of Land, now high Ground, was once overflowed by the Sea) were ſince petrefied, or truly Stones, *ſui Generis*, I leave to the Honourable Society to determine. But when I conſider the conſtant and diſtinct ſhooting of ſeveral Salts, Nature's Curioſity, in every thing, ſo far exceeding that of Art, that the moſt Ingenious, when referr'd thereto, ſeem only endued with an Apiſh fondneſs, I cannot think any thing too difficult or wonderful for Nature; and indeed, I do not apprehend, why it may not be as feaſible to ſuppoſe them to have been Rocks, at firſt ſhot into thoſe Figures, as to conceive the Sea to have amaſs'd ſuch a vaſt Number of Oyſter-ſhells one upon another, and afterwards ſubſiding, ſhould leave them cover'd with ſuch Mountains of Earth, under which they ſhould petrefie: But not to launch forth too far into thoſe Diſputes, ſince I muſt modeſtly remember to whom I write. Often, in the looſer Banks of Shells and Earth, are found perfect Teeth petrefied, ſome whereof I have ſeen, could not be leſs than two or three Inches long, and above an Inch broad: Tho' they were not Maxilary Teeth, the part that one might ſuppoſe grew out of the Jaw, was poliſh'd, and black, almoſt as Jett; the part which had been faſten'd in the Jaw and Gums, was brown, and not ſo ſhiningly poliſh'd, or ſmooth; if they were, as they ſeemed to be, really Teeth, I ſuppoſe, they muſt have been of Fiſhes. The Back-bone of a Whale, and as I remember, they told me of ſome of the Ribs, were digg'd out of the ſide of a Hill, ſeveral Yards deep in the Ground, about four Miles diſtant from *James-Town*, and the River. Mr. *Baniſter*, a Gentleman pretty curious in thoſe things, ſhew'd me likewiſe the Joynt of a Whale's Back-bone, and ſeveral Teeth, ſome whereof, he ſaid, were found in Hills beyond the Falls of *James* River, at leaſt, a Hundred and fifty Miles up into the Country. The Soyl in general is ſandy: I had deſigned, and I think it might be worth a Critical Remark, to obſerve, the Difference of Soyls ſeem appropriated to the ſeveral ſorts of Tobacco: for there is not only the two diſtinct ſorts of a Sweet-ſcented, and Aranoko Tobacco, but of each of theſe be ſeveral ſorts much different, the Seeds whereof are known by diſtinct Names, they having given them the Names of thoſe Gentlemen moſt famed for ſuch ſort of Tobacco, as of *Prior*-ſeed, &c. Nay, the ſame ſort of Seed in different Earths, will produce Tobacco much different, as to goodneſs. The richer the Ground, the better it is for Aranoko Tobacco, whoſe Scent is not much minded, their only aim being to have it ſpecious, large, and to procure it a bright Kite's-foot colour. Had not my Microſcopes, &c. Tools to grind Glaſſes, been caſt away, with my other things, I had made ſome Critical Enquiries into their ſeveral Natures, I would have examin'd what Proportions of Salts, all the ſorts of Earths had afforded, and how Water impregnated with their Salts, would have changed with infuſing Galls, how with the Syrup of Violets, and how they would have precipitated Mercury, or the like, and ſo far forth as I had been able, examined them by the ſeveral Tryals of Fire. I conceive Tobacco to be a Plant abounding with Nitro-Sulphurious Particles; for the Planters try the goodneſs of their Seed, by caſting a little thereof into the Fire; if it be good, it will ſparkle after the manner of Gunpowder: ſo will the Stalks of Tobacco-leaves, and perhaps has ſomething analagous to the Narcotick Sulphur of *Venus*, which the Chymiſts ſo induſtriouſly labour after. The World knows little of the efficacy of its Oyl, which has wonderful Effects in the curing of old inveterate Sores, and Scrophulous Swellings, and ſome, otherwiſe applied and qualified. The goodneſs of Tobacco I look on primarily conſiſts in the volatility of its Nitre: And hence the ſandy Grounds that are moſt impregnated therewith, and whoſe Nitrous Salt is moſt volatile, for ſuch Grounds are quicklieſt ſpent, yield Tobacco's that have the richeſt Scent, and that ſhortly becomes a pleaſant Smoak; whereas, in Tobacco that grows on ſtiff Ground, the Salts ſeem more fix'd, and lock'd up in the Oyl, ſo that whilſt new, 'tis very heady and ſtrong, and requires ſome time for its Salts to free themſelves, and become volatile; which it manifeſts, by its having an Urinous Smell. The ſame Reaſon ſatisfies, why Tobacco that grows on low Lands as far as the Salts, tho' the Plant be never overflowed with Salt Water, yet the Ground that feeds the Plant being impregnated with Salt Water, that Tobacco ſmoaks not pleaſantly, and will ſcarcely keep Fire, but do all that a Man can, will oft go out, and gives much trouble in frequent lighting the Pipe, 'till after it has been kept ſome conſiderable time: which may be aſſign'd to the fixeder Saline Particles of the Marine Salt in theſe Plants, whieh require more time e're they be render'd volatile. Here it might be worthy an Enquiry into the Nature of Filtration of Plants, ſince we may hence gather, Particles of the Marine Salt are carried along with the *Succus Nutritius* of the Plant; concerning which, if it were not too much to deviate from the Matter in hand, I ſhould offer ſome Reflections of my own, which the Learned Society might perhaps improve: for I think thence might be made many happy Conjectures as to the Virtues of Plants. So where we ſee Plants, or Trees, of an open Pore growing low, we ſhall find their Juice has ſubtile parts: So have all Vines, whether the Grape Vine, or Briony, or a Smilax, or the like. If a Gummous Plant or Tree, that grows low, and cloſe pored, it abounds with acid Spirits, as *Lignum Vitæ, &c.* if it grow tall, and be open pored, it abounds with a ſubtile volatile Spirit, as your Firrs, and the Turpentine Tree. But to inſiſt no further herein, than as this may be applicable to the preſent Diſcourſe: for I have obſerved, that that which is called Pine-wood Land, tho' it be a ſandy Soyl, even the Sweet-ſcented Tobacco that grows thereon, being large and porous, agreeable to Aranoko Tobacco; it ſmoaks as courſly as Aranoko: wherefore 'tis, that I believe the Microſcope might make notable Diſcoveries towards the knowledge of good Tobacco: for the cloſer the Compoſition of the Leaf, the better the Tobacco; and therefore the Planters and Merchants brag of the Subſtance of their Tobacco; which word, did they always take it in a true ſence, for the Solidneſs, and not miſtake it for the Thickneſs, it would be more conſonant to a true Obſervation: for as I ſaid of the Pine-wood Tobacco, ſome of it is thick and not ſolid, and differs from the beſt Tobacco, as Buff does from Tann'd Leather; ſo that if the Tobacco be ſound and not rotten, you may give a great gueſs at the goodneſs of Tobacco, when you weigh the Hogſheads, before you ſee them: for if an equal care be taken in the Packing of them, the beſt Tobacco will weigh the heavieſt, and pack the cloſeſt. Now I ſaid, that the Sweet-ſcented Tobacco moſt in vogue, which was moſt famed for its Scent, was that that grew on ſandy Land; which is true, if you would ſmoak it whilſt new, or whilſt only two or three Years old; but if you keep the ſtiff Land Tobacco, which is generally a Tobacco of great Subſtance five or ſix Years, it will much excel: for tho' the ſandy Land Tobacco abound with a volatile Nitre at firſt, yet the ſtiff Land Tobacco abounds with a greater quantity of Nitre, only that it is lock'd up in its Oyl at firſt, and requires more time to extricate itſelf, and become volatile; but the Pine-wood Land having little of the Nitro-

Sulphurious Particles, neither is, nor ever will make any thing of a rich Smoak. Diſcourſing hereof ſome days ſince, to a Gentleman of good Obſervation, that has been verſed with Maulting, he aſſured me, to back this my Suppoſition, or Hypotheſis, he had obſerved, That Barly that grew on ſtiff Ground, required more time conſiderably to mellow, and come to perfection, than that that grew in light Land. Having proceeded thus far to ſpeak of Tobacco, I ſhall add one or two things more. The Planters differ in their Judgments about the Time of Planting, or Pitching their Crops: ſome are for Pitching their Crops very early, others late, without any diſtinction of the Nature of the Soyls; and 'tis from the different Effects that they find, in that, ſometimes early, ſometimes the late Planting ſucceeds: but they have not the Reaſon to judge of the Cauſe, to conſider the Accidents of the Year, and the Difference of the Soyls. In ſandy Grounds they need not ſtrive ſo much for early Planting, the looſeneſs of the Earth, and the kind natured Soyl, yielding all that it can, eaſily and ſpeedily, and Sand retaining the heat, makes the Plants grow faſter. But in ſtiff Soyls, if the Crops be not early pitch'd, ſo that during the Seaſon of Rains it have got conſiderable Roots, and ſhot them ſome depth, if early Droughts come, it ſo binds the Land, that the Roots never ſpread or ſhoot deeper, or further than the Hill that they are planted in: for they plant them as we do Cabbages, raiſing Hills to ſet every Plant in, about the bigneſs of a common Mole-hill: obſerving this on the Plantation where I lived, that it was ſtiff Ground, I adviſed them to plant their Crops as early as poſſible; and in order thereunto, I tried ſeveral ways to further the Plants; but not to trouble you with the ſeveral Experiments that I made, in reference thereto: What I found moſt advantagious was, by taking an infuſion of Horſe-dung, and putting thereon Soot, and then my Seeds; this I kept

Forty eight Hours in an ordinary digeſtive heat, I had two Beds left me to Sow, in the midſt of thoſe the People ſow'd, and the quantity of Seed that they generally allotted to the ſame quantity of Ground ; when I ſow'd, I mix'd Aſhes with the Seed, having decanted the Liquor, that the Seed might ſow the evenner : the effect was, that my Plants came up much ſooner, grew ſwifter, and I had five Plants for one more than any of the other Beds bore ; I left the Country ſhortly after, and ſo had no certainty of the final Reſult. There be various Accidents and Diſtempers, whereunto Tobacco is liable, as the Worm, the Flie, Firing to Turn, as they call them, French-men, and the like. I propoſed ſeveral ways to kill the Worm and Flie, as by Sulphur and the like; but had no opportunity to experiment it : I ſhall ſet down that I had moſt hopes of, which perhaps may give a hint to others to try or improve : Tobacco-ſeed is very ſmall, and by conſequence ſo is the young Plant at firſt, that if gleamy Weather happen at that time, it breeds a ſmall Flie, which conſumes the Plume of the Plant ; now it being early in the Year when they Sow the Seed, *viz.* about the 14th of *January*, they cover the Ground, to ſecure, as well as they can, their tender Plants, from the nipping Froſts, that may happen in the Nights ; they cover them only with a few Oak-leaves, or the like ; for Straw they find apt to harbour and breed this Flie : I therefore would adviſe them to ſmoak Straw with Brimſtone, once in two or three Nights, and ſo they might cover them ſecurely, with that which would preſerve them infinitely beyond the Covering with Oak-boughs; indeed, I would adviſe them to keep peculiarly ſo much of their *Indian* Corn-blades, which they gather for their Fodder, for this very purpoſe, being, as I conceive, much the beſt, there being no Chaff to foul their Beds, and prejudice them when they ſhould weed them. What they call Firing is this : When Plants are of ſmall Subſtance, as when there has been a very wet and cold Seaſon, and very hot Weather ſuddenly enſues, the Leaves turn brown, and dry to duſt; the Cauſe I conceive to be hence: The Plant being feeble, and having a ſmall quantity of Oyl, which makes the more ſolid part of the Plant, the Earth being ſuddenly heated by the Sun's fiercer Beams, the Roots are rather ſcorch'd and dried up in the Earth, than nouriſh'd; ſo that the Plant conſiſting only of watry parts, is conſumed, as it were, by Fire: ſometimes hopeful Plants, when by a ſudden Guſt ſome Maſter Veins are broken, if ſudden heat enſues, they likewiſe Fire: for being not come to maturity, and being deprived of the Supports of Life and Vegetation, they likewiſe periſh, are dried up, and fall to duſt. *French-men* they call thoſe Plants, whoſe Leaves do not ſpread and grow large, but rather ſpire upwards, and grow tall; theſe Plants they do not tend, being not worthy their Labour. Were they ſo Critical, I believe, they might have great Gueſs what Plants were moſt likely to turn *French-men*, by obſerving whether the Roots of the Plants run downwards, as thoſe whoſe Branches are apteſt to ſpire upwards: for tho' I have not made poſitive proof thereof, I have ſomething more than bare fancy for my conjecture; I have pull'd up ſome of theſe *French-men*, and compar'd them with the Roots of ſome other Plants, and found them much longer than others; and 'tis obſervable, looſe Soyls, and ſandy Ground, are more ſubject thereto than the ſtiff Land. The Country of itſelf is one entire Wood, conſiſting of large Timber Trees of ſeveral ſorts, free from Thickets or under Wood, the ſmall Shrubs growing only on Lands, that have been clear'd, or in Swamps; and thus it is for ſeveral Hundreds of Miles, even as far as has yet been diſcover'd. But that ſhall be reſerv'd 'till another opportunity.

I am, &c.

III. *An*

III. *An Extract of a Letter from Mr.* Anthony Van Leeuwenhoek, *to the* R. S. *containing his Obſervations on the Seeds of* Cotton, Palm, *or* Date-ſtones, Cloves, Nutmegs, Gooſeberries, Currans, Tulips, Caſſia, Lime-Tree: *On the Skin of the Hand, and Pores, of Sweat, the Cryſtalline Humour, Optic Nerves, Gall, and Scales of Fiſh: and the Figures of ſeveral ſalt Particles*, &c.

SInce my former Obſervations on the Seeds of Plants, (Vide *Philoſoph. Tranſact.* N° 199, p. 700.) I was ſurprized to find a Variety from what I then wrote concerning the Mealy and Oily Subſtance, as likewiſe the *Embrio-plant* itſelf, to be nouriſht by them; in the Seeds of *Cotton*, which lie Eight or Nine in cluſters, in the *Cotton-wool* that comes from *India:* For having opened the hard Shell or Rind, with which the Seeds are covered, and from whence the Cotton proceeds, and ſtripping them from that curious, thin, whitiſh Coat, which wraps up each Seed ſo as to look like a little round Egg, the Seed itſelf ſhew'd, as Figure 1. which I have drawn larger Fig. 2. *ABC*; diſſecting and opening this, I found no Mealy Subſtance at all, but four ſmall Leaves enwrapping one another, and compaſſing the Root that lay in the midſt of them. Theſe Leaves are repreſented Fig. 3. *DEFGH*, ſufficiently large, to ſhew the Veſſels and dark green Globules between them. *ED* is the Root, in which were but few Globules. Some of theſe Globules being diſſected, ſome Particles of them were of the faireſt light Green I ever ſaw, others were of a very dark Green: *a b c* are Three ſmall Pins I faſten'd the Leaves down with. Theſe Leaves, as I ſaid, were ſpotted all over with little Specks; and enquiring of ſome that had ſeen the *Cotton* grow, they told me, the Leaves of the Plant itſelf were thus ſpotted. So that we ſee, that Nature in this Subject, does not only wrap up the future Plant, but ſuch a little Plant whoſe very Leaves are the ſame as on the grown Tree, only ſmaller.

This brought to my Mind that I had obſerved in the Eggs of ſome Inſects (taken out of their Bodies) none of that Subſtance deſigned for the Nutrition of the *Embrio*; but that in theſe Eggs were contained perfect and living Animals: ſo that as theſe Animals are perfect in the Egg, even whilſt it is yet in the *Uterus* of the Parent, ſo the Cotton-ſeed contains a perfect Plant, even whilſt it yet hangs on the Tree; and beſides, that part whence the Root grows is very large. And as the forementioned Animalcules need no Yolk in the Egg, being already perfect and fitted to ſearch their Food abroad, ſo the Seeds of this Plant contain ſuch an *Embrio-plant* as is already fit to ſhift for itſelf, and as ſoon as it falls from the Tree, the wet it meets with burſts the Shell, and it ſtrikes Root, and diſplays its Leaves.

I cut the little Root tranſverſe; and whereas the innermoſt part in others is round or oval, in this it was eight-ſided, wherefore I have drawn it Fig. 4. *ABCD*. This part was full of Pores, and encompaſs'd with a ſmooth white Body, in which I could ſee no Pores, *EFGH*, and this again was environed with another Body like the innermoſt, full of Pores, only they were ſmaller, *IKLM*. Tho' ſome of the Seeds I examin'd were very old, yet they contained a great deal of Oyl, and in ſome the Embrio was ſo freſh, that I thought it might grow, tho' I could never yet meet with a Seed that would.

Before I had made any Obſervations on Date-ſtones, I thought no other, but that the hard ſhell was only the covering to the Seed or Kernel; but I found it quite otherwiſe : for that very hard part is furniſht with plenty of Pores, and little *Tubuli*, ſerving for the Nouriſhment of the *Embrio-plant* contained in the midſt, which is ſoft and eaſily cut with a ſharp Knife. Altho' I have often obſerved in that part which is to be the Root and Trunk, very many long ſlender Fibrous parts, like Veſſels lying by one another,and ſome of them fill'd with a White ſubſtance, yet I could never diſcover that part which gives beginning to the young Leaves. Some of theſe Date-ſtones I kept in hot moiſt Sand , and after ſome time, that part which is to be the Root and Plant, was ſhot out half an Inch ; but for all this I could not diſcover the Rudiments of any Leaves, I only found the part ſhot out to conſiſt of long ſlender Particles, ſomething ſmaller than thoſe that I had obſerved in the beginning of the ſtem. I found ſome larger Veſſels alſo of another form, coming from the beginning of the ſtem. Fig. 5. ſhews, The Date-ſtone with that ſide upper-moſt, as it is to be ſowed. Fig. 6. ſhews, That ſide that is to be placed downwards in the Earth ; *A*, a round crooked part whence the Embrio proceeds. Fig. 7. Shews it when it has lain ſo long in the Earth, till the ſtem was grown to the length *BC*. Fig. 8. As it ſhew'd when the Root and Stem was of the length *DE*. In this Stem I obſerved nothing remarkable, only ſome large wide Veſſels, whence I judged the Palm-Tree conſtited of a very brittle infirm Wood ; and from a cavity in the midſt thereof, I judged the Tree to be hollow, as the Bamboo, and ſome other *Indian* Plants are ; and altho this part being ſtill included in the other hard part, was increaſed one 36th part bigger than it was before it was put into the hot Sand, I could obſerve nothing material, I only ſaw that which makes the Root ; and indeed, the Origine of a Plant is more like to nothing than a little Muſhroom, as it grows on the Ground.

I choſe ſome of the largeſt Cloves I could find, called Mother-Cloves ; for they are uſually gathered while unripe : in ſome very large ones, which I judged perfectly ripe, I examined the inſide only, and found it to conſiſt of two parts, lying one upon the other ; which tho' they lie with ſeveral Angles, aud each in a different manner, yet they are the Kernels, or Medullary part : for between theſe the *Embrio-plant* is placed, and is joyned to them by Ligaments, by means of which it is nouriſh'd. The beginning of the *Embrio-plant* is delineated Fig. 9. wherein *EFG* ſhews the complicated Leaves. *BCDE* and *GHIK*, the Broken Ligaments which are joyned to every part of the Kernel or Medulla ; which manner of Union is in many Seeds, but in ſome Seeds the joyning is only where the Trunk and Root begins. *ABKL* is that part of the young Plant, whence the Stem or Root begins,of which this is but a ſixth part : this was of a dark Green, full of ſeveral very ſhining Globules : I wetted that part whence the Stem proceeds, otherwiſe it was too brittle to cut, and then ſticking to the Knife, it preſently turned black, by reaſon of the Salt it contained, tho' before it was very white. Fig. 10. *MNOP* is one of theſe Pieces ſo cut off, in which the tranſparent ſhining Globules repreſented in the former Figure between *A* and *L*, are here ſeen cut through. I could diſcover but few Pores in the outward Skin, by reaſon moſt of them were ſhrunk and dried up. I endeavoured to make ſome of the Mother-Cloves to vegetate by ſowing them in Sand ; but in vain only, one time I made the little Leaves of the Embrio begin to open themſelves , as Fig. *B* —— *Q R S*, in which Leaves the aforementioned ſhining Globules were viſible, tho' in the other Leaves they were not. The manner of curing Cloves in *India*, is by ſoaking them in Salt-water, and drying them in the Smoak, which makes them look ſo black, which when I heard of a Gentleman that had lived there, it put an end to my farther Tryals.

I examined Nutmegs, as well preſerved, as dry ones, and found always under the Mace a thin Skin, before we come to the hard Shell, and in one place a Ligament by which it was united to the Tree, which entered the hard Shell, and was joyned to the Nut at that part whence the Root ſhoots out: which was all I could find, they being, as I ſuppoſe, gathered green, and ſpoil'd in the curing, ſo that they will not grow.

I took the largeſt Gooſeberries, and in the Seeds of them, whereof there are ſometimes near Sixty in one Berry, each nouriſht with a peculiar Ligament; viewing the *Embrio-plant*, I not only found the forемention'd parts, but could diſcover the aſcending Veſſels, as Fig. 11. *ABCD*. Examining the proportion the *Embrio-plant* in theſe Seeds bears to the Seed itſelf, I found the Seed ſeven times longer, broader, and thicker than the *Embrio-plant*, that is Three hundred times the Bulk thereof.

Out of one of the largeſt Black Currans, I took Sixty three Seeds, each furniſht with a particular Ligament, the *Embrio-plant* in theſe, was ſuch as is repreſented Fig. 12. *EFH*, is that part whence the Root and Stem proceed. *FGH* are the two Leaves: in this, I reckon, the Seed is above Sixty times bigger than the little Plant. Hence we may conclude, there is no Seed but what has its *Embrio plant*.

I have been often told, that the Flowers of the Tulip might be ſeen in the Bulb thereof; which I could never believe, and ſhould rather look for it in the perfect Seed; however, I have cut open many Bulbous-roots, but could never meet with any thing material. Examining Tulip-ſeeds, I found the Origine of the Plant, oblong, and round at each end, furniſhed with aſcending Veſſels.

Since many have doubted of the Truth of my Diſcoveries, and becauſe I am a zealous Lover of Truth, for the ſatisfaction of the Incredulous, I made choice of two Seeds, *viz.* the Seed of *Caſſia*, and of the ſmall *Olive*: in the laſt whereof we may with our naked Eye diſcern, not only the young Plant in the Kernel, for it is very large, but the Membranes enwrapping it, and the Ligament, and that the better, becauſe the Ligament is of a different colour from the Membrane. And in *Caſſia-ſeed* are obſervable, the young Plant, and eſpecially the Leaves, which I conceive are ſo large, for the better nouriſhing the Root, which is in this Seed very ſmall, and by ſowing it in wet Sand, the Root began to ſhoot down the Leaves, diſplay themſelves, and the young Plant appear between them.

The Seed of the Lime-Tree is the moſt pleaſant Spectacle: for in theſe, the young Leaves neither lie plain, nor are wrapt up, but wrinkled like the firſt Leaves of Trees in the Spring of a pleaſing green Colour, and with a Microſcope, the Fibres of the Leaves are very viſible, and contrary to moſt other Seeds, the Root of the Embrio grows next the Tree.

In the great heat of the Summer, I obſerved ſeveral little tranſparent Pimples on my Hand, containing a clear Liquor, which I ſuppoſed were cauſed by the Skin, not permitting the Sweat to paſs through it; wherefore I cleanſed well, part of the Skin of my Hand, and by my Microſcope, in a ſpace not bigger than a Sand, I ſaw the Sweat iſſuing out at about Fifty places, which as they touched, joyned together into one little Bubble.

After drinking about a Quart of *French*-Wine over Night, I found my ſelf a little out of order the next Morning, at Dinner I drank a Pint and half more, and after about Two Hours, I drank Half a pint of Tea very hot, that I might throw my ſelf into a Sweat; which taking off my Face as clean as I could, I examined it, and found therein a great number of ſuch Scales as conſtitute the outward Skin, and very many Globules about $\frac{1}{6}$ of the bigneſs of a Blood-Globule, and yet a much greater number of much ſmaller Globules, and amongſt theſe a great number of ſalt Particles very ſmall, yet of a curious four-ſided Figure, which as the moiſture exhaled, joyned together in miſhapen Figures, which with the leaſt moiſture of the Air turned to Water again, among theſe were ſome few of the ſhape of Willow-leaves, and like the Figures made by *Sal Armoniac.* I made this Experiment, to ſee if any of the ſalt Particles to be found in my Sweat, were like thoſe found in Wine; which tho' I attempted three days ſucceſſively, yet I could not diſcover any.

Another day, after Dinner, when I had drank no Wine, I obſerved my Sweat, and found as before, the Scales, Globules, and ſalt Particles, which were ſquare, and ſome pyramidal, others were longiſh, others branched, which was only by the uniting of ſeveral ſmall ones.

A learned Perſon cauſed the little Furrows in his Hands to be deſigned, ſuppoſing them to be the Pores whence the Sweat iſſues forth; which I could never imagine: for I have obſerved the Sweat to come more from the Ridges than out of the ſaid Furrows: and examining theſe Furrows, I found more and cloſer Scales in the Furrows than on the Ridges. Wherefore, I conclude, that theſe Indentings are the places where the Scarf-skin is moſt united to the Skin underneath it.

I examined the *Cryſtalline Humour* of an Horſes Eye, and found it little different from an Oxes, Hogs, Sheeps, *&c.* only it was very large, ſo that its greater Axis was $\frac{5}{6}$ of an Inch. I formerly obſerved, that there was no cavity in the *Optic Nerve* of an Oxes Eye, but that its ſubſtance was made up of very many Fibres or Threads, which were filled with gently flowing Globules, (and that if one of theſe Globules in one of theſe Threads) neareſt to the Eye, were moved by the Object, by this means not only the next, and ſo ſucceſſively all the Globules in that Thread; and laſtly, the Brain itſelf would be moved. I have found the ſame ſince in the Optic Nerves of four Horſes Eyes, and if it be not allowed that the ſight is thus performed, yet it muſt be granted, that great plenty of new matter continually thus flows from the Brain for the nouriſhment and generation of the Eyes.

I examined the Gall of a Trout, and found therein a very great quantity of ſmall Globules, leſſer than Blood-gobules, and yet a greater number of much ſmaller ones ſcarce to be diſcovered by my beſt Microſcopes, ſo that I think it impoſſible the Liquor ſhould be ſo very fluid, unleſs theſe Globules ſometimes changed Figure, and that eaſily as they paſs by each other. But what Method ſoever I made uſe of, yet I could not diſcover any ſalt Particles therein, which was my aim.

I obſerved the Skin of a very large Eel, and found the Scales on the Back and Belly, in ſtrait Rows one upon another, but thoſe on the ſides were ſome ſloaping towards the Belly, others towards the Back, but all downwards. Examining the Matter or Slime covering theſe Scales, which is generally thought to come from without to the Scales, whereas it is a real part of the Body itſelf, furniſht with Capillary Veſſels, and Veins admirably interwoven; of which ſome are ſo very ſlender, that if a common Blood-gobule were divided into a Thouſand parts, one of theſe could yet ſcarce paſs them. From which Obſervations I conclude, this Slime is but as the *Cuticula* that covers the Scales, and if theſe be rubb'd off by any external Accident, the Eel will not live long. This outward Skin of Eels, as I call it, I found cover'd with very ſmall round Particles, not a fourth part ſo big as thoſe whereof the Scales ſeem to be conſtituted.

That Slime alſo wherewith the *Bream* is covered, is nothing elſe but a kind of *Cuticula*, tho' the Veſſels thereof are ſo very ſmall as to require a very excellent Microſcope; and this ſubſtance is likewiſe cover'd with extream minute Globules, This commonly called Slime, does not only proceed from the innermoſt Skin of the Fiſh, but partly out of the Scales: for I diſcovered clearly that part of the repreſented Scales. Fig. 13. *BCD*, was united to a very great number of ſmall Veſſels, ſo that the remaining part of the Scale *AB*, *DE*, had no Veſſels or Slime proceeding from it, which laſt part was covered only by the Veſſels that proceeded out of the other Scales. The Veſſels producing this Slime, proceeded not only from the outer part of the Scale, but from that ſide alſo which is next the Fiſh; which upper and under Veſſels proceeding to the gibbous part of the Scale *BCD*, intermix there. The remainder of the Scale *AB*, *DE*, is partly covered by Veſſels coming out directly from the Skin. Secondly, By Veſſels proceeding from within, from *FGH*. Thirdly, By Veſſels proceeding from the gibbous parts of the Scales 1,2, 3. it is neceſſary, that no Veſſels forming this Scarf-skin, ſhould proceed from *AB*, *DD*, otherwiſe the Fiſh could not bend itſelf, if no part of the Scales were free, but that they were all cloſely united together; whereas, by this means, they can eaſily ſlip over one another. The Veſſels that proceed from one Scale in Eels, extend themſelves over at leaſt Twenty five Scales, and interweave with others, whence proceeds that extraordinary toughneſs obſerved in their Slime.

Next I viewed the Scales of *Perch*, and found them likewiſe furniſh'd with ſuch a ſort of Slime or Skin alſo, the difference being only in that the Veſſels making it are much ſtronger, ſo that it is not ſo eaſily rubb'd off, and is defended by little Pricks that ſtick out at the ends of the Scales.

Being not fully ſatisfied with theſe Obſervations, I proceeded to ſearch for theſe Veſſels in the Scales themſelves, and to repreſent the Make of the Scales, I have drawn a very ſmall part of one which in the Microſcope, ſhewed like clear Cryſtal, with ſeveral ſtreaks one under another, *vs* Fig. 14, *IKLM.* *IM* is that part that is joyned to the Skin of the Fiſh, and is about as long as two ordinary Sands. I told five Ridges from *I* to *K*; the *Bream* from whence I took this Scale, I judged about twelve Years old. The Make of theſe Scales, with the Manner how the Streaks croſs one another, is beſt underſtood by the Figure *KLN.*

I ſet ſome Beer-Vinegar in my Cloſet, and after eight or ten days, I found therein a great number of ſalt Particles, ſharper than thoſe I had formerly ſeen in Wine-Vinegar: I have drawn them Fig. 15. *A.* In ſome I ſaw a little cavity in the middle; others were, as I thought, not perfectly formed, wanting one Point, as *B.* others were a great many joyned together: I put ſome Crabs-Eyes into the Vinegar, and then the ſalt Figures were ſo ſmall, and all encompaſſed with little Particles, that I could not diſcover any perfect ſalt Particles.

Juice of Lemons and Citrons afforded me no ſalt Particles, but after freezing, and a litte ſettling at the bottom of the Vial, the clear Juice yielded plenty of them, much like thoſe of Wine and Beer-Vinegar, repreſented *AB.*

Spirit of *Sal Armoniac*, after a while expoſing in my Cloſet, began to ſhoot, and examining the Figures, I found a great many ſmall Particles coagulated into one little Maſs, each of which were a little longer than broad, with a little cavity, ſo that it ſeemed as if they had been plain at firſt, and that the ſides turned up. I viewed a little of this Spirit, 'till it ſhot into Salts before my Eyes, which it did in an inſtant, like Lightning; but the Figures by this means made, were like little irregular Pipes, ſo that I am not certain concerning the Figures in this Spirit.

I mixt ſome of this Spirit with an equal quantity of Blood,and at firſt could ſee no alteration: but in about $\frac{1}{4}$ of an hour ſeveral of the Blood-globules were diſſolved, and the Spirit mixt with the *Serum* lookt reddiſh; in another Quarter there were but few Globules undiſſolved, and the *Serum* lookt redder than before.

I got a little Phial of the famous *Sal volatile Oleoſum*, and looking upon it in the open Air, I admired to ſee ſo great a quantity of Oyl get together in the little Globules, amongſt which ſome were not bigger than Blood-globulees ſwimming in a thin Water; ſo that it is this Oyl only which gives it the yellow colour. It is obſervable, that this Oyl did not ſeparate from the watry part, 'till it had been expoſed to the Air, and ſome part evaporated. Next I examined the Figures of the Salts, of which ſome were ſo ſmall, that I could not ſee their ſhape; others were ſuch as is repreſented, Fig. 16. *A*; others like *B*, ſuch as I have ſeen in Wine, and ſome of a Cubical Figure like common Salt, as *C*: there were a great number of other Particles, which by reaſon of their number, and the thick matter in which they were, could not well be diſcerned, they were of a dark colour, and may be reckon'd Globules. Then I took $\frac{1}{4}$ of this *SVO*, and put to it $\frac{3}{4}$, or more, of ſtrong Wine-Vinegar, and having ſhook it well together, after an hour's time I viewed it; but the ſalt Particles were in as great a quantity in the Vinegar, as if no *S.V.O.* had been mixt therewith: the ſame happened when I put equal parts of both together. I taſted this laſt mixture, and found it very ſour: I repeated it with other *S.V.O.* bought at another place, with much the ſame ſucceſs, only there happened to be a little bit of ſtraw in the Phial, conſiſting of three little Pipes, Fig. 17. *ADEF*, about which were preſently gathered ſeveral little Air-bubbles, *BCDG*, which growing bigger and bigger, ſeparated themſelves from the bit of ſtraw and burſt. I have often obſerved, that a ſmall Globule of Air as *B* has been above a larger as *A*. which Globule has not riſen upward to *C*, and ſo to *D*, but been thruſt downwards to *A*, whence it was diſtant about two hair's breadths, and immediately upon touching united therewith. I have likewiſe obſerved, that a little Air-bubble as *G* , looſening itſelf from the ſtraw, when a larger Bubble, as *F*. was underneath it, has there reſted immovable in the Liquor, when at the ſame time other much ſmaller Bubbles have riſen to the top thereof. The reaſon of the ſtanding ſtill of the Bubble *G*, I ſuppoſe was from a double motion it is impelled to,the one upwards from its being ſpecifically higher than the Liquor, the other downwards, by which it was protruded, to joyn with the other larger Bubble *F*. Tho' I have ſeen ſeveral Effects of Sympathy, if we may ſo call it, yet I never ſaw any ſo manifeſt as this, of the deſcending of a Bubble contrary to its levity, to unite with another.

IV. *An Inſtance of the Excellence of the Modern* ALGEBRA, *in the Reſolution of the Problem of finding the* Foci *of Optick Glaſſes univerſally.* By E. Halley, *S. R S.*

THE Excellence of the *Modern Geometry* is in nothing more evident, than in thoſe full and adequate Solutions it gives to Problems : repreſenting all the poſſible Caſes at one view, and in one general Theorem many times comprehending whole Sciences ; which deduced at length into Propoſitions, and demonſtrated after the manner of the *Ancients*, might well become the Subjects of large Treatiſes : For whatſoever Theorem ſolves the moſt complicated Problem of the kind, does with a due Reduction reach all the ſubordinate Caſes. Of this

I now deſign to give a notable Inſtance in the Doctrine of *Dioptricks.*

This Dioptrick Problem is that of finding the *Focus* of any ſort of *Lens*, expoſed either to Converging, Diverging or parallel Rays of Light, proceeding from, or tending to a given Point in the *Axis* of the *Lens*, be the *ratio* of *Refraction* what it will, according to the nature of the Tranſparent Material whereof the *Lens* is formed, and alſo with allowance for the thickneſs of the *Lens* between the *Vertices* of the two Spherical Segments. This Problem being ſolved in one Caſe, *mutatis mutandis* will exhibit Theorems for all the poſſable Caſes, whether the *Lens* be *Double-Convex* or *Double-Concave*, *Plano-Convex* or *Plano-Concave*, or *Convexo-Concave*, which ſort are uſually called *Meniſci.* But this is only to be underſtood of thoſe Beams which are neareſt to the *Axis* of the *Lens*, ſo as to occaſion no ſenſible difference by their Inclination thereto; and the *Focus* here formed is by *Dioptrick Writers* commonly called the principal *Focus*, being that of uſe in *Teleſcopes* and *Microſcopes.*

Let then (in Fig. 18.) BEβ be a double Convex *Lens*, C the Center of the Segment EB, and K the Center of the Segment Eβ, Bβ the thickneſs of the *Lens*, D a point in the *Axis* of the *Lens*; and it is required to find the point F, at which the Beams proceeding from the point D, are collected therein, the *ratio* of Refraction being as *m* to *n*. Let the diſtance of the object DB = DA = d (the point A being ſuppoſed the ſame with B, but taken at a diſtance therefrom, to prevent the coincidence of ſo many Lines) the *Radius* of the Segment towards the Object CB or CA = r, and the *Radius* of the Segment from the Object Kβ or Kα = ρ, and let Bβ the thickneſs of the *Lens* be = t, and then let the Sine of the Angle of incidence DAG be to the ſine of the refracted Angle HAG or CAφ as *m* to *n*; And in very ſmall Angles the Angles themſelves will be in the ſame proportion; whence it will follow that,

As d to r, ſo the Angle at C to the Angle at D, and $d+r$ will be as the Angle of incidence GAD; and again as m to n, ſo $d+r$ to $\frac{dn+rn,}{m}$ which will be as the Angle GAH = CAφ. This being taken from ACD which is as d, will leave $\frac{m-n\,d-n\,r}{m}$ analogous to the Angle AφD, and the ſides being in this caſe proportional to the Angles they ſubtend, it will follow, that as the Angle AφD is to the Angle ADφ, ſo is the ſide AD or BD to Aφ or Bφ: that is Bφ will be $=\frac{m\,d\,r}{m-n\,d-n\,r}$ which ſhews in what point the beams proceeding from D would be collected by means of the firſt Refraction; but if $n\,r$ cannot be ſubſtracted from $m-n\,d$, it follows that the Beams after Refraction do ſtill paſs on diverging, and the point φ is on the ſame ſide of the *Lens* beyond D. But if $n\,r$ be equal to $m-n\,d$ then they proceed parallel to the *Axis*, and the point φ is infinitely diſtant.

The point φ being found as before, and Bφ—Bβ being given, which we will call δ, it follows by a proceſs like the former, that βF or the focal diſtance ſought, is equal to $\frac{\delta\,\rho\,n}{m-n\,\delta+m\,\rho}=f$. And in the room of δ ſubſtituting Bφ—Bβ $=\frac{m\,d\,r}{m-n\,d-n\,r}-t$, putting p for $\frac{n}{m-n}$ after due reduction this following Equation will ariſe,

$$\frac{m\,p\,d\,r\,\rho-n\,d\,\rho\,t+n\,p\,r\,\rho\,t}{m\,d\,r+m\,d\,\varrho-m\,p\,r\,\varrho-m-n\,d\,t+n\,r\,t}=f.$$

Which Theorem, however it may ſeem operoſe, is not ſo, conſidering the great number of *data* that enter the Queſtion, and that one half of the terms ariſe from our taking in the thickneſs of the *Lens*, which in moſt caſes can produce no great effect, however it was neceſſary to conſider it, to make our Rule perfect. If therefore the *Lens* conſiſt of *Glaſs*, whoſe Refraction is as 3 to 2 'twill be $\frac{6dr\rho - 2d\rho t + 4r\rho t}{3dr + 3d\rho - 6r\rho - dt + 2rt} = f$. If of *Water*, whoſe Refraction is as 4 to 3 the Theorem will ſtand thus $\frac{12dr\rho - 3d\rho t + 9r\rho t.}{4dr + 4d\rho - 12r\rho - dt + 3rt} = f$. If it could be made of *Diamant*, whoſe Refraction is as 5 to 2, it would be $\frac{\frac{10}{3}dr\rho - 2d\rho t + \frac{4}{3}r\rho t}{5dr + 5d\rho - \frac{10}{3}r\rho - 3dt + 2rt} = f$. And this is the univerſal Rule for the *foci* of double Convex Glaſſes expoſed to Diverging Rays. But if the thickneſs of the *Lens* be rejected as not ſenſible, the Rule will be much ſhorter, *viz.* $\frac{pdr\rho}{dr + d\rho - pr\rho} = f$, or in Glaſs $\frac{2dr\rho}{dr + d\rho - 2r\rho} = f$. all the terms wherein t is found being omitted, as equal to nothing. In this caſe, if d be ſo ſmall, as that $2r\rho$ exceed $dr + d\rho$, then will it be $-f$, or the *focus* will be Negative, which ſhews that the Beams after both Refractions ſtill proceed Diverging.

To bring this to the other Caſes, as of Converging Beams, or of Concave Glaſſes, the Rule is ever compoſed of the ſame terms, only changing the ſigns of + and —; for the diſtance of the point of Concourſe of converging Beams, from the point B, or the firſt ſurface of the *Lens*, I call a negative diſtance or $-d$; and the Radius of a Concave *Lens* I call a negative Radius or $-r$ if it be the firſt ſurface, and $-\rho$, if it be the ſecond ſurface. Let then converging Beams fall on a double Convex of Glaſs, and the Theorem will ſtand thus $\frac{-2dr\rho}{-dr-d\rho-2r\rho}=+f$. which ſhews that in this caſe the *Focus* is always affirmative.

If the *Lens* were a *Meniſcus* of Glaſs, expoſed to diverging Beams, the Rule is $\frac{-2dr\rho}{-dr+d\rho+2r\rho}=f$. which is affirmative when $2r\rho$ is leſs than $dr-d\rho$, otherwiſe negative : But in the caſe of converging Beams falling on the ſame *Meniſcus*, 'twill be $\frac{+2dr\rho}{+dr-d\rho+2r\rho}=f$. and it will be $+f$ whilſt $d\rho-dr$ is leſs than $2r\rho$, but if it be greater than $2r\rho$, it will always be found negative or $-f$. If the *Lens* be double Concave, the *focus* of converging Beams is negative, where it was affirmative in the caſe of diverging Beams on a double Convex, *viz.* $\frac{-2dr\rho}{+dr+d\rho-2r\rho}=f$, which is affirmative only when $2r\rho$ exceeds $dr+d\rho$: But diverging Beams paſſing a double Concave have always a negative *focus*, *viz.* $\frac{-2dr\rho}{+dr+d\rho+2r\rho}=-f$.

The Theorems for Converging Beams are principally of uſe to determine the *focus* reſulting from any ſort of *Lens* placed in a Teleſcope, between the *focus* of the Object-glaſs and the Glaſs it ſelf ; the diſtance between the ſaid *focus* of the Object-glaſs and the interpoſed *Lens* being made $=-d$.

I here ſuppoſe my Reader acquainted with the Rules of Analytical Multiplication and Diviſion, as that $+$ multiplied by $+$ makes the product $+$, $+$ by $-$ makes $-$, and $-$ by $-$ makes $+$, ſo dividing $+$ by $+$ makes the Quote $+$, $+$ by $-$ makes $-$, and $-$ by $-$ makes $+$, which will be neceſſary to be underſtood in the preceding Examples.

In caſe the Beams are parallel, as coming from an infinite diſtance, (which is ſuppoſed in the caſe of Teleſcopes) then will d be ſuppoſed infinite, and in the Theorem $\frac{p\,d\,\rho\,r}{d\,r + d\,\rho - p\,r\,\rho}$ the Term $p\,r\,\rho$ vaniſhes, as being finite, which is no part of the other infinite terms and dividing the remainder by the infinite part d, the Theorem will ſtand thus $\frac{\rho\,\rho\,r}{r+\rho} = f$, or in Glaſs, $\frac{2\,r\,\rho}{r+\varrho} = f$.

In caſe the *Lens* were *Plano-Convex* expoſed to diverging Beams, inſtead of $\frac{p\,d\,\rho\,r}{d\,r + d\,\varrho - p\,r\,\varrho}$, r being infinite, it will be $\frac{p\,d\,\varrho}{d - p\,\varrho} = f$. or $\frac{2\,d\,\varrho}{d - 2\,\varrho} = f$, if the *Lens* be Glaſs.

If the *Lens* be Double-Convex, and r be equal to ϱ, as being formed of Segments of equal Spheres, then will $\frac{p\,d\,\varrho\,r}{d\,r + d\,\varrho - p\,r\,\varrho}$ be reduced to $\frac{p\,d\,r}{2\,d - p\,r} = f$; and in caſe d be infinite, then it will yet be farther contracted to $\frac{1}{2}\,p\,r$, and p being $= \frac{n}{m-n}$ the focal diſtance in Glaſs will be $= r$, in Water $1\frac{1}{2}\,r$, but in Diamant $\frac{1}{3}\,r$.

I am ſenſible that theſe Examples are too much for the compleat Analyſt, though I fear too little for the leſs Skilful, it being very hard, if poſſible, in ſuch matters, ſo to write as to give ſatisfaction to both; or to pleaſe the one, and inſtruct the other. But this may ſuffice to ſhew the extent of our Theorem, and how eaſy a Reduction adapts any one caſe to all the reſt.

Nor is this only uſeful to diſcover the *focus* from the other propoſed *data*, but from the *focus* given, we may thereby determine the diſtance of the Object, or from the *focus* and diſtance given, we may find of what Sphere it is requiſite to take another Segment, to make any given Segment of another Sphere caſt the beams from the diſtance d to the *focus* f. As likewiſe from the *Lens*, *focus*, and diſtance given, to find the *ratio* of Refraction, or of m to n, requiſite to anſwer thoſe *data*. All which it is obvious, are fully determined from the Equation we have hitherto uſed, *viz.* $p d \varrho r = d r f + d \varrho f - p r \varrho f$, for to find d the Theorem is

$$\frac{p r \varrho f}{r f + \varrho f - p \varrho r} = d,$$ the diſtance of the Object.

For ϱ the Rule is $$\frac{d r f}{p d r + d f + p r f} = \varrho$$

But for p will be $$\frac{d r f + d \varrho f}{d \varrho r + f \varrho r} = p,$$ which latter determines the *ratio* of Refraction, m being to n as $1 + p$ to p.

I ſhall not expatiate on theſe Particulars, but leave them for the exerciſe of thoſe that are deſirous to be informed in Optical Matters, which I am bold to ſay are comprehended in theſe three Rule, as fully as the moſt inquiſitive can deſire them, and in all poſſible caſes; regard being had to the Signs + and −, as in the former caſes of finding the *focus*. I ſhall only ſhew two conſiderable uſes of them; the one to find the diſtance whereat an Object, being placed ſhall by a given *Lens* be repreſented in a *Species* as large as the Object it ſelf, which may be of ſingular uſe, in drawing Faces, and other things in their true Magnitude, by tranſmitting the *Species* by a Glaſs into a dark Room, which will not only give the true Figure and Shades, but even the Colours themſelves, almoſt as vivid as the Life. In this caſe d is equal to f, and ſubſtituting d for f in the Equation, we ſhall have $p\,d\,r\,\varrho = d\,d\,r \maltese d\,d\,\varrho - d\,p\,\varrho\,r$, and dividing all by d. $p\,r\,\varrho = d\,r + d\,\varrho - p\,r\,\rho$, that is $\frac{2\,p\,r\,\varrho}{r \maltese \varrho} = d$; but if the two Convexities be of the ſame Sphere ſo as $r = \varrho$ then will the diſtance be $= p\,r$, that is, if the *Lens* be Glaſs $= 2\,r$, ſo that if an Object be placed at the Diameter of the Sphere diſtant, in this caſe the *focus* will be as far within as the Object is without, and the *Species* repreſented thereby will be as big as the Life; but if it were a *Plano-Convex*, the ſame diſtance will be $= 2\,p\,r$, or in Glaſs to four times the *Radius* of the Convexity; but of this method I may perhaps entertain the Curious in ſome other Tranſaction, and ſhew how to magnifie or diminiſh an Object in any proportion aſſigned, (which yet will be obvious enough from what is here delivered) as likewiſe how to erect the Object which in this method is repreſented inverted.

A ſecond uſe is to find what Convexity or Concavity is required, to make a vaſtly diſtant Object be repreſented at a given *focus*, after the one ſurface of the *Lens* is formed; which is but a Corollary of our Theorem for finding ϱ, having p, d, r and f given; for d being infinite, that Rule becomes $\frac{r\,f}{p\,r - f} = \varrho$, that is in Glaſs $\frac{r\,f}{2\,r - f} = \rho$, whence if f be greater than $2\,r$, ϱ becomes Negative, and $\frac{r\,f}{f - 2\,r}$ is the *Radius* of the Concave ſought.

Thoſe that are wholly to begin with this Dioptrical Science cannot do better than to read with Attention a late Treatiſe of Dioptricks, publiſhed by *W. Molineux*, Eſq; R. S. S. who has at large ſhewn the Nature of

Optick Glaſſes, and the Conſtruction and Uſe of Microſcopes and Teleſcopes; and though ſome nicely Critical have endeavoured to ſpy faults, and to traduce the Book, yet having long ſince examined it with care, I affirm, that if I can judge, it hath but two things that with any Colour may be call'd faults; the one an over-careful acknowledgment of every Trifle the Author had received from other; and the other, that he labours to make eaſie this curious Subject, ſo little underſtood by moſt, in a manner perhaps too familiar for the *Learned Critick*, and which demonſtrates that it was writ *cum animo docendi*, both which require but very little Friendſhip or good Nature in the Reader, to paſs for Vertues in an Author.

But to return to our firſt Theorem, which accounting for the thickneſs of the *Lens*, we will here again reſume, *viz.*

$$\frac{mpdr\rho - nd\rho t + npr\rho t}{ndr + md\varrho - mpr\varrho - m - ndt + nrt} = f.$$

And let it be required to find the *focus* where a whole Sphere will collect the Beams proceeding from an Object at the diſtance d; Here t is equal to $2r$ and $r = \varrho$. And after due Reduction the Theorem will ſtand thus, $\frac{mpdr - 2ndr + 2nprr}{2nd + 2nr - mpr} = f$, but if d be infinite, it is contracted to $\frac{mpr}{2n} - r = \frac{2n - m}{2m - 2n} r = f$, wherefore a Sphere of Glaſs collects the Suns Beams at half the Semi-diameter of the Sphere without it, and a Sphere of Water at a whole Semi-diameter. But if the *ratio* of Refraction m to n be as 2 to 1, the *focus* falls on the oppoſite ſurface of the Sphere, but if it be of greater inequality it falls within.

Another Example ſhall be when a Hemiſphere *is* expoſed to parallel Rays, that is d and ϱ being infinite, and $t = r$, and after due Reduction the Theorem reſults $\frac{nn}{mm - mn} r = f$. That is, in Glaſs it is at $\frac{4}{3} r$, in Water at $\frac{9}{4} r$, but if the Hemiſphere were Diamant, it would collect the Beams at $\frac{4}{15}$ of the *Radius* beyond the Center.

Laſtly, As to the effect of turning the two ſides of a *Lens* towards an Object; it is evident, that if the thickneſs of the *Lens* be very ſmall, ſo as that you neglect it, or account $t = 0$, then in all caſes the *focus* of the ſame *Lens*, to whatſoever Beams, will be the ſame, without any difference upon the turning the *Lens*: But if you are ſo Curious as to conſider the thickneſs, (which is ſeldom worth accounting for) in the caſe of parallel Rays falling on a *Plano-Convex* of Glaſs, if the plain ſide be towards the Object, t does occaſion no difference, but the focal diſtance $f = 2r$. But when the Convex ſide is towards the Object, it is contracted to $2r - \frac{2}{3}t$, ſo that the *focus* is nearer by $\frac{2}{3}t$. If the *Lens* be double Convex the difference is leſs; if a *Meniſcus* greater. If the Convexity on both ſides be equal, the focal length is about $\frac{1}{6}t$ ſhorter than when $t = 0$. In a *Meniſcus* the Concave ſide towards the Object encreaſes the focal length, but the Convex towards the Object diminiſhes it. A General Rule for the difference ariſing on turning the *Lens*, where the *Focus* is Affirmative, is this $\frac{2rt - 2\varrho t}{3r + 3\varrho - t}$, for double Convexes of differing Spheres. But for *Meniſci* the ſame difference becomes $\frac{2rt + 2\varrho t}{3r - 3\varrho + t}$; of which I need give no other demonſtration, but that by a due Reduction it will ſo follow from what is premiſed, as will the Theorems for all ſorts of Problems relating to the *foci* of Optick Glaſſes.

V. *An Abſtract of a Letter ſent from* Mr. Samuel Dale *to Mr.* John Houghton, S. R. S. *concerning the making of* Turnep-Bread *in* Eſſex.

SIR,

THE dearneſs of all ſorts of Corn hath occaſioned many poor People to ſet their Wits, as it were, on Tenter-hooks, and to try many ways and methods of making Bread for the Suſtenance of their Families, as in ſome places, of Peaſe, and frequently of Barley: ſo with us they have lately got a way of making it with Turneps, which not only for the novelty thereof, but alſo becauſe it may be of general uſe and benefit to poor, mean and indigent people, I will beg your patience until I acquaint you with the way and manner of making it, which is this: They take pilled Turneps, and boyl them in Water until they are ſoft or tender; then preſſing ſtrongly out the Juice, they mix them; being beaten or pounded very fine and ſmall, with their weight of Wheat-Meal. Then adding Salt *q. s.* and warm Water, they knead it up as other Dough, or Paſte, which having lain a little while to ferment, they order it, and bake it as common Bread. Of this Turnep-Bread (for ſo they call it) I have both ſeen and taſted, and can aſſure you, that to the Eye it's not to be diſtinguiſht from common Wheaten or Houſhold Bread, neither doth the Scent much betray it, eſpecially when cold; only to dainty and nice Palates the Turneps are a little, and but a little, perceived.

Yours

Braintree, Dec. 6.
1693.

Samuel Dale.

VI. *An*

VI. *An Extract of a Letter from Sir* R. Bulkley *concerning the Propagation of Elms by Seed.*

THIS is to acquaint you that I have diſcourſed a poor meer *Iriſh* Labourer (who by having work'd many years under a Head Gardiner in a Gentleman's Garden, has got a Genius of Planting) who has follow'd the Propagating of Elms by the Seed (a way, if known, totally neglected among all Planters) which Seed he finds in the former part of the Year; and he has rais'd in ſmall Beds ſuch vaſt numbers of them, that he ſells them of three or four Foot long at Two Shillings a Hundred, and will carry them any where within Five Miles, and plant them into the Bargain.

VII. *An*

VII. *An Account of a Book Intituled,* Phalænologia nova ſive Obſervationes de Rarioribus quibuſdam *Balænis* in *Scotiæ* Littus nuper ejectis, *&c.* Aut. *Roberto Sibbald, Edinburgi* in *Quarto*, 1692.

THE Author of that Excellent Book, Entituled, *Scotia Illuſtrata* ; hath in this given us a Curious Specimen of the advance he hath made in the Natural Hiſtory of that Kingdom ; containing many Obſervations altogether new, and very well worthy to be known. In the Preface he propoſes to treat only of ſuch Whales as are found in the Seas of *Scotland* ; and having prov'd from ſeveral Writers, that the *Brittiſh* Ocean was formerly frequented by Whales, he obſerves, that tho' the very large Whales, which were formerly found in the *Brittiſh* Seas, and were accounted the vaſteſt in the World, ſeem ſince Navigation has been ſo much uſed in theſe Seas, to have retired to *Greenland*, yet there are ſtill a great many ſmaller Whales, and ſome larger ones too, caſt upon the Shores of *Scotland* every Year. He then gives the ſeveral diſtinctions of them ; 1*ſt*, Some are very large, CXX, CXXXIV Feet long, ſome of a ſmaller ſize down to XXIV, XVIII Feet, or leſs. 2*dly*, Some have only two Fins, others have a third upon their Back. 3*dly*, Some have a Pipe or Spout in their Snout, others have Noſtrils. 4*thly*, Some have Teeth, others have horny Plates, in their Mouths.

The Book is divided into Three Sections, in which he firſt treats of the ſmaller Whales, and ſo proceeds to ſpeak of thoſe that are larger. The Firſt Section is concerning the leſſer ſort of Whales, both thoſe that have a Spout, and thoſe that have Noſtrils, as well ſuch as have Teeth in both their Jaws, as thoſe that have them only in the lower.

The Second Section concerns the larger Whales, which have Teeth only in the lower Jaw. In the Third Section we have an Account of thoſe Whales, that have horny Plates in their upper Jaw; which Plates we in *England* improperly call Whale-bone.

In the Firſt Section he enumerates the ſeveral ſorts of Whales that have Teeth, by way of Preface; and in the Firſt Chapter ſpeaks of the ſmaller ſort of Whales, whereof he gives a large Deſcription, as likewiſe he hath done of all; the reſt that follow theſe, have Teeth in both their Jaws, by the *Engliſh* called the *Grampus*; they are voracious and fierce Enemies to other Whales, and it may be thought that their fury many times drives the large Whales upon the Shore: thoſe have a Spout and Three Fins. The Second Chapter treats of a ſort of Whales, that have Teeth only in their lower Jaw, and without any Fin on the Back, which have not been deſcrib'd by any Author: theſe have Noſtrils. The Third, of the leaſt ſort, of Whales, of an uncertain Claſs. He obſerves, That the Fleſh of ſome of thoſe being buried at the Roots of ſome Fruit-Trees, thoſe Trees bore abundantly the next Year.

In the Second Section he treats of the larger Whales, which have Teeth only in their lower Jaw. In the Preface he takes notice of two ſorts; but that which has but one Tooth, and is taken for the Unicorn, not being ever

ſeen

ſeen in thoſe Seas, the Author ſays nothing of it. He ſhews wherein the ſeveral ſorts of the larger Whales that have Teeth do agree, and wherein they differ.

In the firſt Chapter he ſpeaks of the great Whales, with a very large Head, that have only two lateral Fins. Theſe as all the reſt of the Whales treated of in this Section, have a Spout. The length of them is from 50, to 80 Feet. The Oyl of theſe Whales is eaſily coagulated with Cold into a hard and white ſubſtance like fat, and is of great uſe in Wounds, Aches, and hard Tumours.

In the Second Chapter we have an Account of the Whale with a large Head, that has a Fin upon his Back, and hookt Teeth in the lower Jaw. In this Whale is found the beſt *Sperma Ceti*, which lies both within, and on the outſide of the Skull; and this laſt is ſometimes two Feet thick.

The Third Chapter concerns the large headed Whale with three Fins, that has ſtreighter Teeth, that are plain at the end. This has been found to have a great quantity of *Sperma Ceti*, of the better ſort.

In the Fourth Chapter the Author gives us an Account of the *Sperma Ceti*, which is of two ſorts; that which is found floating on the Sea, and that which is found in the Whale. He concludes this Chapter with the Vertues of it, and affirms it to be a true natural *Sal Volatile Oleoſum.*

The Fifth Chapter is concerning the Teeth of theſe Whales, where he propoſes the Experiment of them in thoſe caſes, where the Horn of the Sea-Unicorn is ſo much commended.

In the Third Section he treats of the large Whales, that have horny Plates in their upper Jaw, which he begins with a Preface concerning theſe Whales in general, and endeavours to prove, that there are no Whales, that have theſe horny Plates in both their Jaws.

The Firſt Chapter is of thoſe kind of Whales which have but two Fins, both thoſe which have a Spout, and thoſe that have none; where the Author makes mention of one that was ſeventy Foot long.

The Second Chapter concerns in general that ſort of Whales that have three Fins, and Noſtrils.

In the Third Chapter we have an Account of the ſort of Whale with three Fins, which has a ſharp Snout, and folds in the Belly, and no Spout, but Noſtrils. He obſerves, that the lateral Fins of it being excarnated, are like the whole Arm, with a Plate-bone, Shoulder-bone, *Radius*, and *Ulna*, *Metacarpus*, and Fingers.

In the Fourth Chapter he treats of the Whale with horny Plates, and three Fins, which has the lower Jaw round, and much broader than the upper. This Whale has no Spout; but two Holes near his Forehead.

In the Fifth Chapter we have ſome Account of a very large Whale of this ſort, caſt upon the Shoar of *Boêna*, in which they found no *Sperma Ceti*.

The Sixth Chapter is of the horny Plates, the Folds, and the Oyl of this ſort of Whales. The Oyl of them is us'd for making of Soap, *&c.* but not in Phyſick.

At the end of the Book we have an Appendix, where the Author firſt makes a ſhort Preface concerning thoſe things that are common to Whales; he obſerves, that they are great Lovers of Ambergriſe, and that it is ſometimes found in their Stomachs. Whether the Ambergriſe is found only in thoſe that have Teeth in their lower Jaw, or in ſome others, or in all, he cannot determine. He obſerves, that they all have a great Love for their Young, carrying them when they are very young, under their lateral Fins, and following them when they are bigger: which he thinks may have given the occaſion of that Fable of the Fiſh that guides the Whale.

The Firſt Chapter of the Appendix is concerning the Fat of Whales. The Second of their Fleſh. The Third of the Whale's Pizzle,and its Uſe in Phyſick. In the Fourth Chapter the Author gives us an Account of Ambergriſe, of its Original, Nature, and Vertues. The laſt Chapter is of the Time when the Whales are ſeen.

Of all theſe Whales the Author hath given an exact Deſcription in the ſeveral Chapters wherein they are mentioned.

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PHILOSOPHICAL TRANSACTIONS.

For the Month of December, 1693.

The CONTENTS.

I. A *Letter from Mr.* John Clayton, *Rector of* Crofton *at* Wakefield *in* Yorkſhire, *to the* Royal Society, *giving a farther Account of the* Soil *of* Virginia, *and Planting of* Tobacco *there, with the Draining of Swamps*, &c. *As likewiſe a Deſcription of the ſeveral* Species *of Birds obſerved there by himſelf, with ſeveral Curious Remarks on the* Heads *of* Fowl, *more particularly of their* Ears, *compared with thoſe of the* Mole, *&c.* II. *Some* Queries *concerning the Nature of* Light *and* Diaphanous *Bodies, propoſed to the* Royal Society *by Mr.* Edm. Halley, *S. R. S.* III. *An Account of two Books.* 1. Pharmacopœia Bateana, *Engliſht by Mr.* William Salmon, *Profeſſor of Phyſick.* 2. Phthiſiologia Lancaſtrienſis *cui acceſſit Tentamen Philoſoph. de aquis Mineralibus*, &c. *Auth.* Carolo Leigh, *M. D.*

I. *Mr.* John Clayton, *Rector of* Crofton *at* Wakefield, *his Letter to the* Royal Society, *giving a farther Account of the Soil, and other Obſervables of* Virginia.

I Shall here preſent you with a Continuation of my Remarks on the River, Soil, and Plants of *Virginia.* And firſt, as to the River on the other ſide the Mountains, ſaid to Ebb and Flow. I have been aſſured by Col. *Bird*, who is one of the Intelligenteſt Gentlemen in all *Virginia*, and knows more of *Indian* Affairs than any Man in the Country, that it was a Miſtake; for that it muſt run into a Lake, now called *Lake Petite*, which is freſh Water; for ſince that time a Colony of the *French* are come down from *Canada*, and have ſeated themſelves on the back of *Virginia*, where *Fallam* and the reſt ſuppoſed there might be a Bay, but is a Lake, to which they have given the Name of *Lake Petite*, there being ſeveral larger Lakes 'twixt that and *Canada.* The *French* poſſeſſing themſelves of theſe Lakes, no doubt will in ſhort time be abſolute Maſters of the Beaver Trade, the greateſt number of Beavers being catch'd there. The Colonel told me likewiſe, that the common Notion of the Lake of *Canada*, he was aſſured was a Miſtake, for the River ſuppoſed to come out of it, had no Communication with any of the Lakes, nor the Lakes one with another, but were diſtinct. But not to ramble after hear-ſay, and other matters; but to return to the Parts of *Virginia* inhabited by the *Engliſh*, which in general is a very Fertile Soil, far ſurpaſſing *England*, for there *Engliſh* Wheat (as they call it, to diſtinguiſh it from *Maze*, commonly called *Virginia* Wheat) yields generally 'twixt Fifteen and

Thirty fold, the Ground only once plow'd; whereas 'tis a good Crop in *England* that yields above Eight fold, after all their toil and labour. And yet in truth 'tis only the barrenneſt Parts that they have cultivated, Tilling and Planting only the High-Lands,leaving the Richer Vales unſtir'd, becauſe they underſtand not any thing of Draining. So that the Richeſt Meadow-Lands, which is one third of the Country, is Boggy, Marſh, and Swamp, whereof they make little Advantage, but looſe in them abundance of their Cattle, eſpecially at the firſt of the Spring, when the Cattle are weak, and venture too far after young Graſs. Whereas vaſt Improvements might be made thereof; for the generality of *Virginia* is a Sandy Land with a ſhallow Soil. So that after they have cleared a freſh piece of Ground out of the Woods, it will not bear Tobacco paſt two or three Years, unleſs Cow-pen'd; for they Manure their Ground by keeping their Cattle, as in the South you do your Sheep, every Night confining them within Hurdles, which they remove when they have ſufficiently dung'd one ſpot of Ground; but alas! they cannot Improve much thus, beſides it produces a ſtrong ſort of Tobacco, in which the Smoakers ſay they can plainly taſte the fulſomneſs of the Dung. Therefore every three or four Years they muſt be for clearing a new piece of Ground out of Woods, which requires much Labour and Toil, it being ſo thick grown all over with Maſſy Timber. Thus their Plantations run over vaſt Tracts of Ground, each ambitioning to engroſs as much as they can, that they may be ſure to have enough to Plant,and for their Stocks and Herds of Cattle to range and feed in, that Plantations of 1000, 2000, or 3000 Acres are common, whereby the Country is thinly inhabited; their Living ſolitary and unſociable; Trading confuſed and diſperſed; beſides other Inconveniencies: Whereas they might Improve 200 or 300 Acres to more Advantage, and would make the Country much more Healthy; for thoſe that have 3000 Acres, have ſcarce cleared 600 Acres thereof, which is peculiarly termed the Plantation, being ſurrounded with the 2400 Acres of Woods; ſo that there can be no free or even motion of the Air, but the Air is kept either ſtagnant, or the lofty Sulphurous Particles of the Air, that are higher than the tops of the Trees, which are above as high again as the generality of the Woods in *England*, deſcending when they paſs over the cleared ſpots of Ground, muſt needs in the violent heat of Summer, raiſe a preternatural Ferment, and produce bad Effects. Nor is it any Advantage to their Stocks,or Crops; for did they but drain their Swamps, and Low-Lands, they have a very deep Soil, that would endure Planting 20 or 30 Years, and ſome would ſcarce ever be worn out, but be ever longer better, for they might lay them all Winter, or when they pleaſed in Water, and the Product of their Labour would be double or treble, whether Corn or Tobacco; and that this is no fond Projection, (though when I have diſcourſed the ſame to ſeveral, and in part ſhewn them how their particular Grounds might be drained at a very eaſie rate) they have either been ſo conceited of their old way, ſo ſottiſh as not to apprehend, or ſo negligent as not to apply themſelves thereto. But on the Plantation where I lived, I drained a good large Swamp, which fully anſwered expectation. The Gentlewoman where I lived, was a very Acute Ingenious Lady; who one day Diſcourſing the Overſeer of her Servants, about pitching the enſuing Year's Crop. The Overſeer was naming one place where he deſigned to Plant 30000 Plants, another place for 15000, another for 10000, and ſo forth the whole Crop, deſigned to be about 100000 Plants: Having obſerved the Year before he had done the like, and ſcattered his Crop up and down the Plantation, at places a Mile, or a Mile and a half aſunder, which was very inconvenient, and whereby they loſt much time. I interpoſed, and asked, why they did not Plant all their Crop together? The Fellow ſmiled as it were at my Ignorance, and ſaid, there was very good Reaſon for it. I replyed, that was it I enquired after. He returned, the Plantation had been an old planted Plantation, and being but a ſmall Plot of Ground, was almoſt worn out, ſo that they had not Ground altogether that would bring forth Tobacco. I told him then they had better Ground than ever yet they had planted, and more than their Hands could manage. He ſmiled again, and asked me, where? I then named ſuch a Swamp. He then ſaid ſcornfully, he thought what a Planter I was; that I underſtood better how to make a Sermon, than managing Tobacco. I replyed with ſome warmneſs, tho' I hoped ſo, that was Impertinence, and no Anſwer. He then ſaid, that the Tobacco there would drown, and the Roots rot. I replyed, that the whole Country would drown if the Rivers were ſtopt, but it might be laid as dry as any Land on the Plantation. In ſhort, we diſcourſed it very warmly, till he told me, he underſtood his own Buſineſs well enough, and did not deſire to learn of me. But the Gentlewoman attended ſomewhat better to my Reaſoning, and got me one day to go, and ſhew her how I projected the draining of the Swamp, and thought it ſo feaſible, that ſhe was reſolved to have it done; and therefore deſired me I would again Diſcourſe her Overſeer, which I did ſeveral times, but he would by no means hearken thereto, and was ſo poſitive, that ſhe was forced to turn him away, to have her Servants ſet about the Work; and with three Men in thirteen days I drained the whole Swamp, it being Sandy Land, ſoaks and drains admirably well, and what I little expected, laid a Well dry at a conſiderable diſtance. The Gentlewoman was in *England* laſt Year, and I think Dr. *Moulin* was by when ſhe asked me. Now to teach her how ſhe might make her Tobacco that grew in that Swamp leſs, for it produced ſo very large, that it was ſuſpected to be of the *Aranoko* kind: I told her, though the Complaint was rare, yet there was an Excellent Remedy for that, in letting every Plant bear Eight or Nine Leaves inſtead of Four or Five, and ſhe would have more Tobacco, and leſs Leaves. Now you muſt know, they top their Tobacco, that is, take away the little top-bud, when the Plant has put forth as many Leaves as they think the Richneſs of the Ground will bring to a Subſtance; but generally when it has ſhot forth four or ſix Leaves. And when the top-bud is gone, it puts forth no more Leaves, but Side-branches, which they call Suckers, which they are careful ever to take away, that they may not empoveriſh the Leaves. I have been more tedious in the Particulars, the fullier to evince how reſolute they are, and conceitedly bent to follow their old Practice and Cuſtom, rather than to receive Directions from others, tho' plain, eaſie, and advantageous. There are many other places are as eaſie to drain as this, tho' of larger extent, and richer Soil, for ſome of which I have given Directions, and have only had the return perhaps of a flout afterwards: Even in *James Town Iſland*, which is much what of an Oval Figure, there's a Swamp runs Diagonal wiſe over the Iſland, whereby is loſt at leaſt 150 Acres of Land, which would be Meadow, which would turn to as good Account as if it were in *England*: Beſides it is the great annoyance of the Town, and no doubt but makes it much more unhealthy. If therefore they but ſcour'd the Channel, and made a pretty ordinary Trench all along the middle of the Swamp, placed a Sluce at the Mouth, where it opens into the back Creek; for the Mouth of the Channel there is narrow, has a good hard bottom, and is not paſt two Yards deep when the Flood is out; as if Nature had deſigned it before hand: They might thus drain all the Swamp abſolutely dry, or lay it under Water at their pleaſure. *I* have talked ſeveral times hereof to Mr. *Sherwood*, the Owner of the Swamp, yet nothing is eſſayed in Order thereto. And now ſince we are ſpeaking of *James Town*, give me leave to adjoyn ſome Reflections as to the Situation and Fortifications of the place. The Natural Situation of the place is ſuch, as perhaps the World has not a more Commodious place for a Town, where all things conſpire for Advantage thereof.

James Town Iſland is rather a *Peninſula*, being joyned to the Continent by a ſmall Neck of Land, not paſt Twenty or Thirty Yards over, and which at Spring-Tides is overflow'd, and is then an abſolute Iſland. Now they have built a ſilly ſort of a Fort, that is, a Brick Wall in the ſhape of a Half-Moon, at the beginning of the Swamp, becauſe the Channel of the River lies very nigh the Shoar; but it is the ſame as if a Fort were built at *Chelſey* to ſecure *London* from being taken by Shipping. Beſides Ships paſſing up the River are ſecured from the Guns of the Fort, till they come directly over-againſt the Fort, by reaſon the Fort ſtands in a Vale, and all the Guns directed down the River, that ſhould play on the Ships, as they are coming up the River, will lodge their Shot within Ten, Twenty, or Forty Yards in the riſing Bank, which is much above the Level of the Fort; ſo that if a Ship gave but a good Broad-ſide, juſt when ſhe comes to bear upon the Fort, ſhe might put the Fort into that confuſion, as to have free Paſſage enough. There was indeed an Old Fort of Earth in the Town, being a ſort of *Tetragone*, with ſomething like Baſtions at the four Corners, as I remember; but the Channel lying further off to the middle of the River there, they let it be demoliſhed, and built that new one ſpoke of, of Brick, which ſeems little better than a blind Wall, to ſhoot Wild Ducks or Geeſe.

If they would build a Fort for the Security of the Town and Country, I conceive it ſhould be on *Archer's Hope Point*, for that would ſtop the Ships from paſſing up the River, before they came to the Town, and would ſecure the Town from being block'd up by Sea. The Channel at *Archer's Hope Point* lies cloſe by the Shoar, and makes ſuch an Angle there by reaſon of *Hog Iſland*, that going up or down the River, let the Wind be where it will, they muſt there bring the contrary Tack on Board, and generally when they About the Ship as they call it, they are ſo nigh the Shoar, that a Man may almoſt fling a Finger-ſtone on Board. How much this hinders the motion of a Ship, and what Confuſion it muſt be to them to bring a contrary Tack on Board, whilſt they have all the Guns of a Fort playing ſo nigh upon them, may readily be conceived. *Archer's Hope* is a Neck of Land, that runs down three Miles long, not much paſt half a Mile broad betwixt the Main River and *Archer's Hope Creek*, which has large Marſhes and Swamps; ſo that a Citadel built upon the Point, would almoſt be Impregnable, being it could be attack'd no way but one, which is ſo narrow a ſlender Neck of Land, that it would be difficult to take it that way: And it would ſecure *James Town* from being block'd, being it would not be paſt a Mile by Water, to the Point of *James Town Iſland*. The Iſland is ſo ſurrounded with Water and Marſhy Land, than the Town could never be Bomb'd by Land. But now to return to the Reflections of Improving, and Manuring of Land in *Virginia*; hitherto, as I have ſaid, they have uſed none but that of Cow-penning; yet I ſuppoſe they might find very good Marle in many places, I have ſeen both the red and blew Marle at ſome breaks of Hills: This would be the propereſt Manure for their Sandy Land, if they ſpread it not too thick, theirs being, as I have ſaid, a ſhallow, Sandy Soil, which was the Reaſon I never adviſed any to uſe Lime, tho' they have very good Lime of Oyſter-ſhels; but that's the propereſt Manure for cold Clay Land, and not for a Sandy Soil. But as moſt Lands have one Swamp or another bordering on them, they may certainly get admirable Slitch, wherewith to Manure all their uplands. But this, ſay they, will not improve Ground, but clods and grows hard; 'tis true, it will do ſo for ſome time, a Year or two at the firſt; but did they caſt it in heaps, and let it lye for two or three Years after a Froſt or two had ſeized it, and it had been well pierced therewith, I doubt not it would turn to good Account: And for this too I have ſomething more than bare conjecture; for Diſcourſing it once with a good notable Planter, we went to view a heap thereof, that caſually he had caſt up 'twixt three and four Years before, and we found it not very binding, but rather a fine Natural Mold, whereupon he did confeſs, he then remembred that out of a ridge of the like Mold he had had very large Plants, which muſt have been of the like Slime or Slitch caſt up before: But ſaid, that himſelf and others deſpaired of this Manure, becauſe they had taken of this Slitch freſh and moiſt out of the Swamp, and filled Tobacco Hills with it, and in the midſt of it planted their Plants, which ſo bound the Roots of their Plants, that they never came to any thing. But he ſaid, he then ſaw his Error, yet I have not heard he has remembred to Correct it. But 'tis ſtrange in how many things beſides they are remiſs, which one would think *Engliſh* Men ſhould not be guilty of. They neither Houſe nor Milk any of their Cows in Winter, having a Notion that it would kill them; yet I perſwaded the afore-mentioned Lady where I lived, to Milk four Cows the laſt Winter that I ſtaid in the Country, whereof ſhe found ſo good Effect, that ſhe aſſured me ſhe would keep to my Advice for the future; and alſo as I had further urged, Houſe them too, for which they have mighty Conveniencies, their Tobacco Houſes being empty ever at that time of the Year, and may eaſily be fitted in two or three days time without any Prejudice; whereby their Cattle would be much ſheltered from thoſe pinching ſharp Froſts that ſome Nights on a ſudden become very ſevere. I had another Project for the Preſervation of their Cattle proved very ſucceſsful; I urged the Lady to ſow her Wheat as early as poſſibly ſhe could, ſo that before Winter it might be well rooted, to be early and flouriſhing at the firſt of the Spring: So that ſhe might turn thereon her weak Cattle, and ſuch as ſhould at any time be ſwamp'd, whereby they might be recruited and ſaved,and it would do the Wheat good alſo. I adviſed her likewiſe to ſave, and carefully gather her *Indian* Corn-tops, and blades, and all her ſtraw, and whatever could be made Fodder, for her Cattle; for they get no Hay, tho' I was urging her to that too, and to ſow *Saintfoin*; for being a Sandy Soil, I am confident it would turn to very good Account. They have little or no Graſs in Winter, ſo that their Cattle are pined and ſtarved, and many that are brought low and weak, when the Spring begins, venture too far into the Swamps after the freſh Graſs, where they periſh; ſo that ſeveral Perſons loſe 10, 20, or 30 Head of Cattle in a Year: I obſerved this was much owing to their Inadvertency and Error in their way of Managing and Feeding them; for they get little Fodder, but as they think Corn being more Nouriſhing, feed them with their *Indian* Corn, which they give them Morning and Evening; they ſpend thus a great quantity of Corn, and when all's done, what ſignifies two or three Heads of Corn to a Beaſt in a Morning? It makes them only linger about the Houſes for more; and after that ſweet Food they are not ſo prompt to brouze on the Trees, and the courſe Graſs which the Country affords. So that thus their Guts ſhrink up, and they become Belly-ſhot, as they call it. I adviſed therefore never to give them any thing in a Morning, whereby as ſoon as they were ſet forth of the Cow-pens, they would fall a feeding, and tho' they filled their Bellies only with ſuch courſe ſtuff as had little Nouriſhment in it, yet it would keep out their Bellies, and they would have a better Digeſtion; and then when they were come home at Nights, to Fodder them, beginning with Straw and their courſeſt Fodder, which they would learn to eat by degrees, before they taſted that that was more delicate, and whilſt their Digeſtion was ſtrong, would yield them Nouriſhment to keep them ſtill ſo, afterwards when the Winter pinched, their fine Fodder then would ſtand them in ſtead; and hereby they might preſerve their weakeſt Cattle,by theſe Methods,and the help of the Wheat-patch. She, the Gentlemowan where I lived, ſaved all her Cattle, and loſt not one in Two Winters after, that I ſtaid there; beſides ſhe ſaved above Twenty Barrels of Corn, as I remember that ſhe told me ſhe uſed to ſpend upon her Stock; and a Barrel of Corn is commonly worth Ten Shillings. Nay further, The laſt Spring ſhe fed Two Beaſts, a Bullock and a Cow, fat, upon her Wheat, with the addition only of a little boil'd Corn, and yet the Wheat was ſcarce eat down enough, but to return again to the nature of the earth, which may be pretty well gathered from what I have already ſaid. I have obſerved, that at Five or Six yards deep, at the breakes of ſome banks, I have found veins of Clay, admirable good to make Pots, Pipes, or the like of, and whereof I ſuppoſe the *Indians* make their Pipes, and Pots, to boil their Meat in, which they make very handſomly, and will endure the Fire better then moſt Crucibles: I took of this Clay, dryed, powdered, and ſifted it; powdered and ſifted potſheards, and glaſs; Three parts, Two parts and One part as I remember, and therewith made a large Crucible, which was the beſt I yet ever tried in my Life; I took it once red hot out of the Fire, and clapt it immediately into Water, and it ſtarted not at all. The Country abounds mightily with Iron Oare, that as I have been aſſured by ſome upon tryal, has been found very good. There are Rocks thereof appear at the precipice of Hills, at the foot whereof there runs a River fit for a Forge, and there's Wood enough to ſupply it with Charcoal; as I have heard there was formerly ſome Perſons undertook the Work, and when they had made but a ſmall quantity of Iron, which proved very good, the *Indian* Maſſacre happened, and they being higher ſeated then the then Inhabited part of the Country, were all cut off, and the Works demoliſhed; ſo that it has frighted others I think from the like attempt; beſides, ſuch a work requires a greater Fund, and Bank of Money to carry it on, then any there are able to lay out; and for Perſons in *England* to meddle therewith, is certainly to be cheated at ſuch a diſtance, ſome *Indians* brought *Coll. Bird* ſome Black Lead, whereof he has told me there was great ſtore. There's very curious Talk towards the falls of *Rapahanock* River, which they burn and make a delicate white Waſh of it. The Secretary of State *Coll. Spencer*, has aſſured me, there were Vitriolick or Alluminous Earths on the Banks of *Potomack*; and thus far of what my Memory ſupplies me, referring to the Earth, in the next place I ſhall give a ſhort account of the Birds.

Of the BIRDS.

I had indeed begun once whilſt I was in that Country to have made a Collection of the Birds, but falling ſick of the Griping of the Guts, ſome of them for want of care Corrupted, which made them fling others away that I had thoroughly cured; for I was paſt taking care of them my ſelf, there remaining but ſmall hopes of my Life.

There are Three ſorts of Eagles, the largeſt I take to be that they call the Grey Eagle, being much of the colour of our Kite or Glead.

The Second is the Bald Eagle, for the Body and part of the Neck being of a dark brown, the upper part of the Neck and Head is covered with a white ſort of Down, whereby it looks very bald, whence it is ſo named.

The Third is the Black Eagle, reſembling moſt the *Engliſh* Eagle; they build their Neſts much after the manner that Dr. *Willoughby* deſcribes, and generally at the top of ſome tall old Tree, naked of Bows and nigh the River ſide, and the People fall the Tree generally when they take the young; they are moſt frequently ſitting on ſome tall Tree by the River ſide, whence they may have a proſpect up and down the River, as I ſuppoſe to obſerve the fiſhing Haukes; for when they ſee the Fiſhing Hauk has ſtruck a Fiſh, immediately they they take Wing, and 'tis ſometimes very pleaſant to behold the Flight, for when the Fiſhing Hauk perceives her ſelf purſued, ſhe will ſcream and make a terrible noiſe, till at length ſhe lets fall the Fiſh to make her own eſcape, which the Eagle frequently catches before it reach the Earth or Water. Theſe Eagles kill young Lambs, Pigs, &c.

The Fiſhing Hauk is an abſolute Species of a Kings-fiſher, but full as large, or larger than our Jay, much of the Colour and Shape of a Kings-fiſher, tho' not altogether ſo curiouſly Feather'd; it has a large Crop, as I remember, there is a little Kings-fiſher much the ſame in every reſpect with ours.

If I much miſtake not, I have ſeen both Goſs, Hauk, and Falcon; beſides there are ſeveral ſorts of the leſſer Kind of Stannels.

There is likewiſe the Kite and the Ringtale.

I never heard the Cuckow there to my remembrance.

There's both a brown Owl and white Owl, much what as large as a Gooſe, which often kills their Hens and Poultry in the Night; the white Owl is a very delicate feather'd Bird, all the Feathers upon her Breaſt and Back being Snow-white, and tipp'd with a Punctal of Jet-black: Beſides there is a Barn Owl much like ours; and a little ſort of Scritch Owl.

There's both the Raven, and the Carrion Crow; I do not remember I ever ſaw any Rooks there, Dr. *Moulin* and my ſelf, when we made our Anatomies together, when I was at *London*, we ſhew'd to the *Royal Society*, that all Flat-bill'd Birds that groped for their Meat, had three Pair of Nerves, that came down into their Bills; whereby as we conceived they had that acuracy to diſtinguiſh what was proper for Food, and what to be rejected by their Taſte when they did not ſee it; and as this was moſt evident in a Duck's Bill and Head, I draw'd a Cut thereof, and left it in your Cuſtody: A Duck has larger Nerves that come into their Bills than Geeſe, or any other Bird that I have ſeen, and therefore quafer and grope out their Meat the moſt: But I had then diſcover'd none of theſe Nerves in Round-bill'd Birds: But ſince in my Anatomies in the Country, in a Rook I firſt obſerved two Nerves came down betwixt the Eyes into the upper Bill, but conſiderably ſmaller than any of the three Pair of Nerves in the Bills of Ducks, but larger than the Nerves in any other Round-bill'd Birds; and 'tis remarkable theſe Birds more than any other Round-bill'd Birds ſeem to grope for their Meat in Cow-dung and the like: Since I have found in ſeveral Round-bill'd Birds the like Nerves coming down betwixt the Eyes, but ſo very ſmall that had I not ſeen them firſt in a Rook I ſhould ſcarce have made the diſcovery; in the lower Bill there are Nerves have much the ſame ſituation with the Flat-bill'd Birds, but very ſmall, and ſcarce diſcernable, unleſs to the Cautious and Curious.

The Night Raven, which ſome call the *Virginia* Bat, is about the bigneſs of a Cuckow, feather'd like them but very ſhort, and ſhort Leg'd, not diſcernable when it flies, which is only in the Evening ſcuding like our Night Raven.

There's a great ſort of ravenous Bird that feeds upon Carrion, as big very nigh as an Eagle, which they call a Turky Buſtard, its Feathers are of a Duskiſh black, it has red Gills, reſembling thoſe of a Turky, whence it has its Name; it is nothing of the ſame ſort of Bird with our *Engliſh* Turky Buſtard, but is rather a Species of the Kites, for it will hover on the Wing ſomething like them, and is carnivorous; the Fat thereof diſſolved into an Oil, is recommended mightily againſt old Aches and Sciatica Pains.

I think there are no Jackdaws, nor any Magpyes; they there prize a Magpye as much as we do their Red Bird.

The *Pica Glandaria*, or Jay, is much leſs than our *Engliſh* Jay, and of another colour, for it is all blew where ours is brown, the Wings marbled as curiouſly as ours are, it has both the ſame Cry, and ſuddain jetting Motion.

There are great Variety and Curioſity in the Wood-peckers, there's one as big as our Magpye, with blackiſh brown Feathers, and a large Scarlet Tuft on the top of the Head: There are four or five ſorts of Wood-peckers more, variegated with green, yellow and red Heads, others ſpotted black and white, moſt lovely to behold. There's a Tradition amongſt them, that the Tongue of one of theſe Wood-peckers dryed will make the Teeth drop out if pick'd therewith, and cure the Tooth-ach (tho' I believe little of it, but look on it ri-

diculous)

diculous) yet I thought fit to hint as much that others may try; for ſometimes ſuch old Stories refer to ſome peculiar Vertues, tho' not to all that is ſaid of them.

There be wild Turkies extream large; they talk of Turkies that have been kill'd, that have weigh'd betwixt fifty and ſixty Pound weight; the largeſt that ever I ſaw, weigh'd ſomething better than thirty eight Pound; they have very long Legs, and will run prodigiouſly faſt. I remember, not that ever I ſaw any of them on the Wing, except it were once: Their Feathers are of a blackiſh ſhining Colour, that in the Sun ſhine like a Dove's Neck, very ſpecious.

Hens and Cocks are for the moſt part without Tails and Rumps; and as ſome have aſſured me our *Engliſh* Hens after ſome time being kept there have their Rumps rot off; which I'm the apter to believe, being all their Hens are certainly of *Engliſh* breed. I'm ſorry I made no Anatomical Obſervations thereof, and Remarks about the Uſe of the Rumps in Birds, which at preſent I take to be a couple of Glands, containing a ſort of Juice for the Varniſhing the Feathers; having obſerved all Birds have much recourſe with their Bills to the Rumps when they dreſs their Plumes, whereby they ſcud through the Air more nimbly in their Flight.

Patridges there are much ſmaller than ours, and reſort in Covies as ours do; their Fleſh is very white, and much excels ours in my mind, *Sed de guſtibus non eſt diſputandum.*

Their Turtle-doves are of a duskiſh blew colour, much leſs than our common Pidgeon, the whole Train is longer much than the Tails of our Pidgeons, the middle Feather being the longeſt. There's the ſtrangeſt Story of a vaſt number of theſe Pidgeons that came in a Flock a few Years before I came thither; they ſay they came through *New England*, *New York* and *Virginia*,

ginia, and were ſo prodigious in number as to darken the Sky for ſeveral Hours in the place over which they flew, and brake maſſie Bows where they light; and many like things which I have had aſſerted to me by many Eye-witneſſes of Credit, that to me it was without doubt, the Relaters being very ſober Perſons, and all agreeing in a Story: nothing of the like ever happen'd ſince, nor did I ever ſee paſt Ten in a Flock together that I remember. I am not fond of ſuch Stories, and had ſuppreſſed the relating of it, but that I have heard the ſame from very many.

The Thruſh and Feldefire are much like ours, and are only ſeen in Winter there, accordingly as they are here.

Their Mocking Birds may be compared to onr Singing Thruſhes, being much of the ſame bigneſs; there are two ſorts, the Gray and the Red, the gray has Feathers much of the colour of our gray Plovers with white in the Wings like a Magpye; this has the much ſofter Note, and will imitate,in its ſinging, the Notes of all Birds that it hears, and is accounted much the fineſt Singing Bird in the World. Dr. *Moulin* and I made in our Anatomy many Obſervations of Singing Birds to this effect: The Ears of Birds differ much from thoſe of Men or Beaſts,there's almoſt a direct paſſage from one Ear to the other of Birds, ſo that prick but the ſmall Membrane called the Drum on either Ear, and Water poured in at one Ear will run out at the other: But this is not all, but what is much more remarkable, they have no Coclea, but inſtead thereof there's a ſmall Cocleous or twiſting Paſſage that opens into a large Cavity, that runs betwixt two Sculls, and paſſes all round the Head, the upper Scull is ſupported by many hundreds of ſmall Thred-like Pillers or Fibers, which as we ſuppoſed had another uſe alſo, to brake the Sound from making any confuſed Eccho, and to make it one and diſtinct; this paſſage we obſerved betwixt the two Sculls was much larger in Singing Birds than in others that do not ſing, ſo very remarkable that any Perſon that has been but ſhow'd this may eaſily judge by the Head what Bird is a Singing Bird, or has aptitude thereto, tho' he never ſaw the Bird before, nor knew what Bird it were: This has often made me reflect how much the Modification of Voices depends upon the acuracy of the Ear, and how deaf Perſons become dumb: And ſince I have obſerved that many Children that have an acute Wit enough that are ſlow of Speech, that is long before they ſpeak are much longer before they can pronounce thoſe Letters that are ſharps, as *g. h. r.* and never have an aptitude to learn to ſing. Hence I judge that Songs that have many Sharps in them are the difficulteſt to ſing well, and diſcover any Perſon's Skill upon the tryal of Muſick moſt. This I ſuppoſe only, having no Skill in Muſick my ſelf, nor having ever diſcourſed any Perſon about it, as I remember we ſhow'd ſome of theſe things to the *Royal Society*, and I drew ſome Cuts thereof, and gave the Doctor upon promiſe that he would put theſe and many other our joynt Obſervations in Print, but I hear he is ſince dead. I have Anatomized moſt ſorts of Creatures, and never found any Four-footed Creature with an Ear like a Bird, unleſs a Mole; and a Mole has an Ear much like them, with a very thin double Scull, and great Cavity like a Bird, and is very acute of hearing, the Scull by reaſon of the large Cavity is very ſlender and eaſily cruſh'd, ſo that a Mole is quickly kill'd with a bruiſe on the Scull like a Lark, and upon the bruiſe the Membranes of the Scull turn black; whence *Segerus* miſtake *Membranæ Cerebri in ſuperficie exteriori omnino nigræ viſæ:* But when I have taken care not to bruiſe the Scull the Membranes were not black at all, both *Segerus* and *Severinus* I think had ſome perceptions of the different Structure of a Mole's Ear, but not any thing of its Analogy to a Bird's Ear; they ſpeak of a Bone *Egregie pumicoſum*: And *Segerus* ſays there's a *Ductus ad oſſis uſque petroſi cavitatem protenſus, plurimis fibrillis Membraneis annectabatur.* But to return, this Mocking Bird having its Name from *Mimicking*, all other Birds in ſinging is a wonderful mettled Bird, bold and brisk, and yet ſeems to be of a very tender Conſtitution, neither ſinging in Winter, nor in the midſt of Summer, and with much difficulty are any of them brought to live in *England*.

The Red Mocking is of a duskiſh red, or rather brown; it ſings very well, but has not ſo ſoft a Note as the gray Mocking Bird.

Of *Virginia* Nightingale, or red Bird, there are two ſorts; the Cocks of both ſorts are of a pure Scarlet, the Hens of a Duskiſh red; I diſtinguiſh them into two ſorts, for the one has a tufted Cops on the Head, the other is ſmooth feather'd: I never ſaw a tufted Cock with a ſmooth headed Hen, or on the contrary; they generally reſorting a Cock and Hen together, and play in a Thicket of Thorns or Bryars in the Winter, nigh to which the Boys ſet their Traps, and ſo catch them and ſell them to the Merchants for about Six Pence apiece; by whom they are brought for *England*; they are ſomething leſs than a Thruſh.

There's a Bird very injurious to Corn, they call a Blackbird; I look on it a ſort of Starling, for they cry ſomething like them but do not ſing, are much what of the ſame bigneſs, have Fleſh blackiſh like theirs; they reſort in great Flocks together, they are as black as a Crow all over their Bills and all, only ſome of them have ſcarlet Feathers in the Pinions of their Wings, *Quære* whether a diſtinct Species.

They have a Lark nothing differing from our common Lark; they have another Bird which they call a Lark that is much larger, as big as a Starling, it has a ſoft Note, feeds on the Ground; and as I remember has the Specifical Character of a long Heel. it is more inclined to yellow, and has a large half Moon on its Breaſt of yellow; if it have not a long Heel, *Quære*, Whether a Species of the Yellow-hammer.

They have a Martin very like, only larger than ours, that builds after the ſame manner. The honourable Col. *Bacon* has remarked for ſeveral Years, that they conſtantly come thither upon the Tenth of *March* one or two of them appearing before, being ſeen hovering in the Air for a Day or two then go away, and as he ſuppoſed return'd with the great Flock. The Colonel delighted much in this Bird, and made like Pidgeon holes at the end of his Houſe with Boards purpoſely for them.

Their Swallow differs but little from ours.

They have a Bird they call a Blew-bird, of a curious azure colour about the bigneſs of a Chafinch.

There be other ſorts of Goldfinches variegated with red, orange and yellow Feathers, very ſpecious and beautiful.

Sparrows not much different from the *Engliſh*, but build not in the Eaves of Houſes that ever I ſaw.

The Snow-bird which I take to be much the ſame with our Hedge Sparrow; this is ſo called becauſe it ſeldom appears about Houſes but againſt Snow or very cold Weather.

The Humming Bird that feeds upon the Honey of Flowers: I have been told by ſome Perſons, that they have kept of theſe Humming Birds alive, and fed them with Water and Sugar; they are much the ſmalleſt of all Birds, have long Bills and curious coloured Feathers, but differ much in colour.

Hearons three or four ſeveral ſorts, one larger than the *Engliſh*, feather'd much like a *Spaniſh* Gooſe.

Another ſort that only comes in Summer Milk white, with red Legs very lovely to behold.

The Bittern is there leſs than in *England*, and does not make that ſounding Noiſe that ever I heard.

Curlews ſomething leſs than our *Engliſh*, tho' bigger than a Wimbrel.

The Sandpiper much reſembling the *Engliſh*.

The Snipe, two ſorts, one reſembling ours, the other much leſs.

The Tewits are ſmaller than the *Engliſh*, and have no long Toppins, but juſt like a young one that begins to flie.

There are great numbers of wild Swans.

Wild-geeſe and Brent-greeſe all Winter in mighty flocks, Wild-ducks innumerable, Teale, Wigeon, Sheldrakes, Virginia-Didapers, the Black-diver, *&c.*

In my return home for *England*, *May* 1686. off of the Banks of *New-found-Land*, when we were according to account, a Hundred Leagues from the Shoar, we ſaw ſeveral prodigious floating Iſlands of the Ice, no leſs to our wonder than Terror, for they were very dangerous: I got the Maſter to ſail one day as nigh one of them as we ſecurely durſt, which we judged to be full a League in length, and was higher above Water than the top of our Main-maſt; the Snow drove to and fro upon it as upon a large Plane. There was a great Flock of ſmall Black-divers, that were not much bigger than a Feldifire, came to us a little before, but all of them then left and betook themſelves to this Iſland of Ice. They dived the conſtantly'ſt, and the longeſt at a time of any Bird that I ever ſaw. We ſaw, as I remember, nigh Thirty of theſe Iſlands of Ice. Captain *Rider* being ſome few days later in his Paſſage, and bearing more to the *Nore*, told me, he ſaw many more of theſe Iſlands of Ice, and ſome much larger.

There

There are in *Virginia* a great many Cormorants; ſeveral ſorts of Gulls, and in about the Bay many Bannets.

Thus much for the Birds.

Yours, &c.

II. *Some Queries concerning the Nature of Light, and Diaphanous Bodies. Propoſed to the Royal Society by* E. Halley.

THE late Curious Book of Mr. *Hugen's* having revived the Diſquiſitions that have formerly been made about the Nature and Phænomena of Light, I thought it not amiſs to propoſe ſome Difficulties that have occurr'd to my Thoughts upon this Subject, by way of Query: Which may perhaps not ſeem unworthy of the Conſideration of this Honourable Aſſembly, *viz.*

1. In what conſiſts the Tranſparency of Glaſs, Chryſtal, Water, *&c.* And whether the Notion of *right Pores* be enough to anſwer all the Appearances of it, eſpecially thoſe of Refraction, and of the Tranſparency of Bodies in all Poſitions; whereas the Rectitude of Pores ſeems to argue an orderly or regular Poſition of the conſtituent Parts, according to the three Dimenſions?

2. Why in Bodies that have much more Pores than Glaſs or Water; as Deal-ſhavings or brown Paper, the Paſſage of Light is wholly obſtructed, though ſeveral groſs Particles will penetrate them?

3. Whether or no the Light is eaſier propagated through Glaſs, Water, *&c.* than Air or Æther, as *des Cartes* and Mr. *Hook* have maintained; and wherein Mr. *Hugens* differs from them, aſſerting that the Beams

of Light are retarded in paſſing thoſe Diaphanous Bodies; and thereby ſo naturally explicating the Laws of Refraction?

4. Suppoſing Light to be propagated in a Wave, how it comes to paſs that this Propagation being either retarded or accelerated in a Diaphanous Body, as Glaſs, *&c.* does, upon its going out of that *Medium*, acquire again the ſame degree of Velocity it had before it came on, there being no new impulſe or impediment to alter the Velocity it had in the other *Medium*?

5. Why *Mercury* being ſo pure, ſimple and homogeneous a Fluid, is almoſt the only one that is not tranſparent?

6. Whether the Reflexion of Light on the Surfaces of Glaſs, Water, and the Shade of the moſt perfect Pellucid being always very diſcernable, be not Arguments that the Beams paſs their *Media* with more difficulty than they do the Air?

7. Whether any Texture of Atoms of the ſame *materia Prima* can be ſuppoſed to anſwer to the *Phænomena* of the Pellucidity of heavy and Opacity of light Bodies?

8. Whether, if light (as it is moſt likely) be a Tremour, Shake, or Undulation of the Æther, as Sound is of the Air; and if the Æther do conſiſt of ſo rarified Parts, as to penetrate all Bodies with full liberty, as is generally ſuppoſed; moſt if not all Bodies ought not to be tranſparent?

9. Whether the Matter of the Univerſe be not of ſeveral Kinds in *Minimis*, and not conſtituted by the various Texture and Coalition of the ſame ſort of Atoms, as it has been held by the *Epicurean* and *Atomical Philoſophers*, which at preſent obtain in the World.

An Account of 2 Books.

I. Pharmacopœia Bateana; *or*, Bate's *Diſpenſatory, Tranſlated into* Engliſh *by* William Salmon, *Profeſſor of Phyſick:* Lond. *Printed for* S. Smith *and* B. Walford, 1694. in 8*vo.*

THE Tranſlator of this Work, in his Preface, gives firſt an Account of the Original, that it is a Collection of moſt excellent *Recipe*'s made by Mr. *James Shipton*, who was the Preparer and Maker up of the greateſt part of them, tho' their Author was the Famous Dr. *Bate*, whom to name is ſufficient, by whoſe Knowledge and Experience this Work was produced.

The firſt Edition was ſo well received by the Learned, that they were ſoon preſented with a ſecond, with an Addition of not only above 100 more of Dr. *Bate*'s *Recipe*'s, but alſo of the *Arcana Goddardiana* from the Author's own Mſs. which much advanced the Value of the Book, ſo that at leaſt 6000 of this Latin Edition were ſold; which was digeſted in an Alphabetical Method with the *Arcana Goddardiana* at the end thereof, which were only *nominal* without their Preparations: Whereas in this *Engliſh* Edition they are at large, and interſperſed in their proper places: The Method of the Book is likewiſe altered claſſically, according to the Method and Order of the Chapters of the *London Diſpenſatory*.

The Work in the *Latin* being thus approved of by the Learned, and eſpecially Phyſicians induced our Author to publiſh this *Engliſh* Edition, as he ſays, for its more general Uſe and Entertainment. Adding ſome Preparations never before Printed, as *Goddard*'s *Drops, Ruſſel*'s *Powder, Emplaſtrum Febrifugium*, with near 50 more valuable *Recipe*'s out of the *Collectanea Chymica*, and other Authors, of which he gives a Catalogue both of the Ancient and Modern which he has conſulted in this Undertaking: Which is not a bare Tranſlation, a Comment being added upon each particular, eſpecially upon all the *Chymical Proceſſes* which he has ſearched out from their original Fountains, and explicated the *Proceſs* it ſelf, adding as a Supplement a *Rationale* upon the ſame, and having examin'd the Preſcripts of other Authors, he ſhews wherein they chiefly differ from theſe, and gives their *Proceſſes* at large, if new.

He promiſes alſo a ſecond Part, being the *Officina Chymica*, or a Compleat Body of *Chymiſtry*, explicating, 1. The Principles of Natural Bodies. 2. The Fornaces and Inſtruments of Art deſcribed with their Figures in Copper Plates. 3. The Operations of Chymiſtry *per ſe.* 4. The Preparations of Metals and Minerals. 5. The Preparation of certain Vegetable and Animal Subſtances.

Next, he obviates ſome Objections againſt the Publiſhing this Work in *Engliſh*, and diſcovering the Secrets of the Art to the Vulgar, which he hopes he has made ſome amends for, by divulging ſeveral Secrets not generally known even by the Learned; amongſt which is the *Prince*'s *Powder*, once accounted a great Secret, and ſold for above 5 *l.* a Doſe; the Preparation whereof is *Lib.* 1. *Cap.* 9. *Sect.* 80. *Pag.* 526. which happens to be omitted in the Table. And as a general Anſwer adds, that all particular Intereſts ſhould be ſacrificed to the Common Good, which ought to be preferr'd before any Private one how dear and valuable ſoever. And juſtifies himſelf in this, by the Examples of *Hippocrates*, *Gallen*, *Paracelſus*, *Celſus* and others, who all publiſht a Syſtem of Phyſick in their own Languages; as likewiſe from the preſent Uſage of the *French*, who now treat of all Subjects in their own Tongue; and as he conceives, they are not to be imitated only in their Vices.

II. Phthiſiologia Lancaſtrienſis, *cui acceſſit* Tentamen *Philoſophicum de aquis Mineralibus*, &c. *Aut. Carolo Leigh, M. D. Lond. Impenſis S. Smith & B. Walford, &c. In* 8vo. 1694.

THE Author divides the Medicinal part of this Treatiſe into ſeveral Heads; and Diſcourſes firſt of the various Kinds and Cauſes of the P*hthiſick*, obſerved by himſelf in that County, which are either *Scorbutic Strumoſe* or *Chyloſe*, and are often the attendants of Fevers epidemic or intermittent, Dropſies, Rickets, Drunkenneſs, Stoppages *Fluores albi*, Jaundice, Rheumatiſms, *&c.* He begins with the Scorbutic proceeding from the ill Temperature of the Air, the Parents or *Errores ſex non naturales*: Giving ſome Experiments of the Alteration of the *Saliva* by a few Drops of ſeveral Vitriolic Liquors, he infers that the Air being fill'd with ſuch Steams, and conveigh'd to the Blood is a great occaſion of this Diſtemper: He obſerves farther that Maritine places are infeſted with Sulphureous ſteams, as well as Salt ones diſcoverable by the *Ignes fatui* in the Night, Stinks, *&c.* and pronounces ſuch places unhealthy. As to the Hereditary, by the way he obſerves, that this Diſeaſe is generally owing to the Father, and that tho' the Mother were of an healthy Conſtitution. He proceeds to give the Symptoms and their Cauſes in the beginning of the Diſtemper, ſuch as want of Appetite, Sweats, Turbid Urine, Diarrhœa's, *&c.* touching in Tranſitu at the Proclivity of the People of *Briſtol* to this Diſtemper. Next, of the Symptoms when the Diſeaſe has gotten more ſtrength, copious ſpitting, Aſthma's, Shiverings and irregular Fevers, *&c.* in the 4*th.* Chapter he propoſes ſeveral general Rules according to the ſeveral States of the Diſeaſe, and proceeds to the Method of Cure both in the beginning, the confirmed State, and more deſperate State of the Diſeaſe, delivering the Forms of ſeveral *Recipe*'s proper for each particular State. Then he preſents the Reader with ſeveral curious Obſervations of Perſons under the ſeveral States of the Diſeaſe, with the Remedies made uſe of and Succeſs. The other Species of the Diſtemper being explicable by the ſame Cauſes, he paſſes them over, and gives an account of the ſeveral particular Phthiſicks, and Obſervations thereon, as Phthiſicks from Spitting of Blood, vomitting of Blood, *Hæmorragia uterina,* an *Impetigo,* or red Pimples and itching Scurf on the Face and other parts of the Body, from a Scorbutic Rheumatiſm, the Rickets, *Fluor albus*, Obſtructions, *&c.* and concludes this Treatiſe with the Chyloſe Phthiſick.

Our Author divides his Philoſophical Eſſay on Mineral Waters into ſeveral Chapters; and in the firſt treats of a Vitriolick Spring near a Cole-Pit, which grows black with Galls, which in 24 Hours is precipitated, and the Water turns greeniſh, it ferments with an Alcali, *&c.* This Water as he affirms againſt Dr. *Liſter,* contains a perfect Vitriol. The Second Chapter is of the *Acidulæ* in general; in many of which he likewiſe affirms a true green Vitriol is found, which with Ocre and Sulphur he makes the Principles of theſe Waters. The Third Chapter treats of ſeveral particular Springs in *Lancaſhire,* in the bottom of one whereof Sea-ſhells are found; of all theſe he made Experiments before and after Diſtillation, and affirms them Vitriolic. In the Fourth Chapter he tells us, That in the Pariſh of *Brindel,* near the River *Darwen* is a Mineral Rock, which from the Taſte and other *Phænomena* he ſays is Vitriolic; this macerated in common Water gives it the Qualities of the ſeveral Medicinal Springs he had before deſcribed. Of which he gives many Experiments; from all which he draws ſeveral

ral Concluſions of the Vitriolick Nature of Waters, *&c.* and anſwering ſome Objections proceeds to Salt Springs, none of which, except Vitriolic, give a blackiſh Tincture with Galls as he avers. He treats next of a Sulphureo-ſaline Spring, a Sulphureous Spring, a Spring impregnated with the Natron of the Ancients, *&c.* Lapideſcent Springs, he ſays are from a certain *Halitus* riſing from Alum and Vitriol, which paſſing through takes along with it ſome Particles of the Lime-ſtone, which being mixt with the Water *per Minima* ſeems to give it the petrifying Quality ; this he confirms by ſome Obſervations and Experiments. He ſpeaks in the next place of Acid Springs, and ends with an Appendix of cold Baths, the Diſeaſes for which they ſeem moſt proper ; and the Manner or Reaſon of their Cure by theſe Baths. So much may ſuffice for a ſhort Account of this Book, which it were to be wiſht the Author had wrote in *Engliſh.*

FINIS.

ERRATA.

NUmb. 202. p. 844. l. 21. r. *in,* p. 847. l. 15. r. *Zenith,* n. 204. p. 933. l. 29. r. *Tolu,* l. 30. r. *are the Fruits,* l. 31. r. *Pomiferous-Tree ; What Aſafœtida,* l. 33. r. *&c. are, and by,* n. 205. p. 970. l. 20. r. *Salt and Yeaſt of each, q. ſ.*

A
GENERAL INDEX:
OR,
Alphabetical Table
To all the
PHILOSOPHICAL TRANSACTIONS,

From *January* $167\frac{7}{8}$. to *December* 1693.

ALSO, A

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Mentioned and Abbreviated in theſe *Tranſactions*,
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A GENERAL INDEX OF THE PHILOSOPHICAL TRANSACTIONS.

From *January* $168\frac{7}{8}$. to *December* 1693. beginning at Number 137. where that Index to Mr. *Oldenburg*'s Tranſactions ended, and ending at Number 206. incluſive.

A

A*Bacus* of the Chineſe and Romans, n. 180. p. 66.

Accenſion by Borrichius's Experiment refuted, n. 150.p.292.

Achmet Kuprioli the great and wiſe Vizir at the Siege of Candia, to whom Panageotti a Learned Greek tranſlated many ancient Books, n. 155. p. 440.

Acouſtic or Phonical Sphere, the Semiplane of it, n.156.p. 486.

Acus Magneticæ Variatio vid Magnet.

Æquations vid Algebra.

Aged Perſons vid Craven.

Agriculture, ſee Plants.

Agues vid Diſeaſes.

Air, the Cauſe of the growth of Stones, Metals, n. 156. p. 496. how to eſtimate the Dryneſs and Moiſture thereof by Oil of Vitriol, n. 156. p. 505. A Diſcourſe concerning its *Gravity*, obſerved in the Baroſcope n. 171. p. 1002. Its oppoſition to *Projects*, n. 179. p. 19. Shooting by its Rarefaction, n.179. p. 21. Specifick *Gravity* of *Air*, n.181. p. 104. How faſt the *Air* ruſhes into an exhauſted Receiver, n. 184. p. 193. Airs effect on Colours, n. 204. p. 898. Reſiſtance of the *Air* to Bodies moved in it meaſured, n. 186. p. 269. Obſervations of the Motion of *Air*-Bubbles in

Fluids, n. 205. p. 960. Of the *Air* of Virginia, n. 201. p. 784. Contagious Diſeaſes communicated by the *Air*, n. 204. p. 906. See more in Barometer and Winds.

Albat nius corrected, n. 204. p. 913.

Alcoran not to be met with in the Turkiſh Language, but in Arabick; frequent Copies among the Perſians in their own Language, Opinion therein of our Saviour and the Chriſtian Religion; with ſeveral Paſſages of the old Teſtament perverted, Pſeudochroniſmes committed, *&c.* with the Turks Superſtition towards it, n. 155. p. 433. *&c.*

Alga marina, and other Sea-Plants the Cauſes of freſh Water, n. 156. p. 493.

Algebra the defects thereof, n. 159. p. 575. Cubic *æquations* reſolved, n. 159. p. 580. The uſe of Curves in *æquations*, n. 159. p. 581. An inſtance of its Excellence in the Reſolution of the Problem of finding the Foci of Optic-glaſſes, n. 205. p. 960.

Altar, ſee Inſcriptions.

Allum-works in England, an Account of them, n. 142. p. 1052. Petrifications uſual found in Alum mines, ib. Miſcroſcopical Obſervations of *Allum*, n. 173. p. 1075.

Almond Furnace, ſee Furnace.

Alphabet univerſal, n. 182. p. 126.

Ambergriſe what by ſome ſuppoſed to be, n. 172. p. 1031. n. 205. 976.

Amulets, ſee Chamaili.

Anatomy of a Chameleon, n. 137. p. 930.

Anatomical Obſervations on the Structure of the Noſe, n. 139. p. 977.

Anat. Obſervat. of an Abſceſs in the Liver, four Ureters, &c. n. 142. p. 1035.

Anatomy of an Hydropical Body, n. 140. p. 1000. A new Method of diſſecting the *Brain*, n. 140. p. 1013.

Anatomy of a Rattle ſnake, n. 144. p. 25. Of the *Aper* Mexicanus Moſchiferus, n. 153. p. 359. Arteria aorta ſtrangely formed. n. 153. p. 371. *Kidney* of an unuſual ſhape. See Kidney. *Lungs* of a Salamandra aquatia. See Lungs. Of the *Meſaraic* Veſſels, n. 153. p. 368. Three *Stomachs* in the Tajacu, n. 153. p. 365. The *Veſica fellea* wanting, p. 368. The *Ureters* inſerted into the Rectum, n. 147. p. 189. Structure of the Uterus, n. 161. p. 630. An Account of a large Preternatural Glanduloſe Subſtance between the Heart and Pericardium of an Ox, n. 167. p. 860.

A prodigious *Os frontis*, n. 168. p. 880. Obſervations on the Chryſtalline Humour. See Chryſtalline Obſervations on the Body of one dead of an Apoplexy, n. 173. p. 1068. Obſervations on Monſters. See Monſters.

A Glandulous Liver, n. 178. p. 1266.

A Morbid Spleen, n. 194. p. 543. Anat. Obſerv. on the Heads of Fowl, n. 199. p. 711. and n. 206. p. 993. Obſervat. on the Teſticles. See Teſticles. Of the Structure and Uſe of the Parts of the Body, n. 196. p. 614.

p. 614. Of the Ovaries of Animals, n. 196. p. 615.

Animalcules in Pepper-water, n. 139. p. 187. in *Male-ſeed* firſt obſerved, n. 142. p. 1040. In Salt-brine, n. 145. p. 97. In the *Milts* of Fiſh, n. 148. p. 207. In *Male-ſeed*, n. 145. p. 76. and n. 155. p. 347. In the *Scurf* of the *Teeth*, n. 197. p. 646. In *Pepper-water* proved to be living Creatures, n. 203. p. 861. In the *Teſticles* of a Rat, n. 196. p. 593.

Animals not meer Machines, n. 202. p. 853.

Animals of Perſia, n. 137. p. 943. How generated. See Generation. All Species created at firſt. n. 202. p. 853. A Table of *Animals*, n. 202. p. 855.

Antidote to the Poyſon of the Viper, n. 144. p. 49.

Antimony. See Gold and Refineing.

Antiquities, Roman Monument, n. 145. p. 70. Roman Ant. at Kirbythore in Weſtmoreland, n. 158. p. 555. An Earthen Veſſel found at York, n. 171. p. 1017. Figures of Pieces of Antiquity, n. 175. p. 1159. n. 176. p. 1201. Two Runic Inſcriptions, n. 178. p. 1287. and 1291. See Characters and Inſcriptions. Saxon Coins found at *Honedon* in *Suffolk*, n. 189. p. 356. n. 203. p. 874. An Ancient *Gauliſh Sepulcher*, n. 185. p. 221. Arms on a Stone buried in France, n. 185. p. 223. See Aqueducts Arches, Inſcriptions.

Ants of an extraordinary ſize, n. 139. p. 978.

Aqua Fortis how made, and its uſe in Refining Metals, n. 142. p. 1046.

Aqueducts near Rome, n. 155. p. 466. Of the 14 ſeen by Procopius, but 4 now left, n. 155. p. 468. An Account of the *Aqueduct* for carrying the River Eure to *Verſailles*, n. 171. p. 1016. n. 176. p. 1206.

Ararat. See Mountains.

Arches of the Bridge at St. *Eſprit* in France, n. 160. p. 584. A peculiar ſort of *Arch* in two Stone Chimneſs in Northamptonſhire, n. 166. p. 800.

Arithmetical Paradox concerning the Chances of Lotteries, n. 198. p. 677. See Algebra.

Arteria. See Anatomical Obſervat.

Aſtronomy. Its uſe in aſcertaining the Times of memorable Actions, n. 193. p. 495. Eclipſes of the Planets. See Eclipſes and Planets. A Table of the *Paralaxes* of ♃'s Orb. and an Ephemeris of his Geocentric places for the Year 1686. n. 177. p. 1215. An Inſtrument for finding the diſtances of ♃'s Satellits from his Axis, n. 178. p. 1262. Albatenius corrected and amended, n. 204. p. 913. See more under Stars.

Atheiſm confuted, n. 137. p. 938.

Democritus and Leucippus the firſt *Atheizens* of the Atomick Philoſophy, n. 137. p. 937.

Atmoſphere, the common Receptacle of Particles of all Figures from whence new weight, increaſe, &c. of Bodies, n. 156. p. 496. The height of the *Atmoſphere*, n. 181. p. 107.

Atomic Philoſophy defended, n. 137. p. 937.

Aurum potabile no deſirable Medicine, n. 157. p. 515.

B

Bajozid (firſt) his Sepulcher, &c. n. 155. p. 433.)

Barbaroſſa's Tomb, n. 152. p. 345.

Barometer, how the Mercury ſtands at given Altitudes from the Earth, n. 181. p. 106. Principal Phænomena of the *Barometer*, n. 181. p. 110. The Cauſe of the ſame, p. 111. See Quickſilver and Winds. A new ſort of *Barometer* increaſing the Diviſions *ad libitum*, n. 185. p. 241. See Atmoſphere.

Barometers height obſerved at *Oxford* for a whole Year, n. 169. p. 932.

Barrenneſs, ſee Bath.

Baſſa, who commonly raiſed to that Power among the Turks, n. 155. p. 436.

Baths (hot) much frequented, at Checkerghe near Conſtantinople, n. 155. p. 433. The effect of the *Bath* in curing the Palſie and Barrenneſs, n. 169. p. 944.

Bees, a ſtrange ſort in the Weſt-Indies, n. 172. p. 1030. Concerning the *Proboſcis* of *Bees*, n. 175. p. 1148.

Bernacles deſcribed, n. 137. p. 925. n. 172. p. 1036.

Birds. Chickens how hatcht at *Cairo*, n. 137. p. 923. *Ducks* bred under Ground, n. 191. p. 425. *Fowls* how taken in Hirta, n. 137. p. 927. *Hawks* taught to fly at the wild Boar, n. 137. p. 943. Anatomical Obſervations on the Heads of *Birds*, n. 199. p. 711. n. 206. p. 993. The *Humming* Bird deſcribed, n. 200. p. 760. A Quere concerning it, n. 202. p. 815. Particulars that may be added to Willoughby's *Ornithology*, n. 175. p. 1159.

Births, an extraordinary Birth in Staffordſhire, n. 150. p. 281. See Monſters.

Blatta Byzantina what, n. 197. p. 640.

Blood, evacuated periodically at the Fingers ends, n. 171. p. 989. Its Colour whence, n. 204. p. 901. See more in Circulation.

Bloody Snow, n. 139. p. 976.

Bodies diſſolved in corroding Menſtrua, why they ſwim therein, n. 181. p. 88.

Bogs in Ireland diſcourſed of, n. 170. p. 948.

Bones, in Man of a cloſer Contexture than the Calculus Humanus, n. 157. p. 531. Twice as heavy as their bulk of Water, n. 157. p. 532. Microſcopical Obſervations on *Bones*, n. 140. p. 1002. n. 202. p. 838. A very large *Os frontis*, n. 168. p. 188. A Diſcourſe of the *Bones*, n. 194. p. 544. *Sculls* of Foul, n. 199. p. 711. 206. 993. *Bones* hardly diſſolved by nitrous Acids, n. 157. p. 532.

Books. See Catalogue of Books.

Borier, what it is, n. 167. p. 854.

Boyling Fountains. See Fountains.

Brain, a new Method of diſſecting it, n. 140. p. 1013. Microſcopical Obſervations on the

Brains

Brains of ſeveral Animals, n. 168. p. 883. &c.

Bread made of Turneps, n. 205. p. 970.

Bricks Roman, their Meaſure, n. 149. p. 240.

Bridg of St. *Eſprit* deſcribed, n. 160. p. 584. n. 163. p. 712. *Deſcription* of a Bridge that may be built 70 Foot long without any Pillar under it, n. 163. p. 714.

Brimſtone but one Species of it, at leaſt in England, it comes from the Pyrites, that which they call Sulphur Vive found about Vulcano's, is caus'd by Sublimation, n. 157. p. 513. The Matter ſuppoſed to be *Brimſtone*, found after Rain, is only the yellow Duſt of the Bloſſoms of the Fir, Pine and Hazel-Trees, blown off by the Winds, n. 168. p. 911.

Brine Pits. See Salt-ſprings; many of them ſtink of *Sulphur*, and turn black with Galls, n. 156. p. 489.

Bubbles of Air in Fluids, n. 204. p. 960.

Buck-skins how dreſt in Virginia, and Carolina, n. 194. p. 531.

Buffalo's of great Service to the Turks, n. 155. p. 444.

Burials, a general Bill of the Burials and Chriſt'nings in *London*, 1685. n. 177. p. 1245. The ſame for the Years, 1686. and 87. n. 191. p. 445. Obſervations on the Breſlaw Bills of *Mortality*, n. 196. p. 596. n. 198. p. 654.

Burning Speculum, its great force, n. 188. p. 352.

Byram time, the great Feſtival among the Turks, n. 155. p. 449.

C

Cabal, a ſort of Drink made of Raiſins and White-wine, n. 163. p. 734.

Cæcum cut out of a Bitch, n. 151. p. 324.

Cæcum of the ſame Structure with the Colon, n. 153. p. 367.

Place of *Cæſar*'s firſt landing in Britain, n. 193. p. 495.

Calculus humanus, a Treatiſe of it, with an Index of the Experiments made thereon, its Nature near that of Bone, not diſſolvible by any but nitrous Acids, n. 157. p. 523. *&c.*

Calculi humani of extraordinary bigneſs, n. 157. p. 534. n. 178. p. 1269. n. 202. p. 817.

Caleſh of a new ſort, n. 172. p. 1028.

Cameleon, Obſervations on it, and its Colours, n. 157. p. 930.

Camels endure Labour 4 Days without Water, n. 155. p. 444.

Camphire obſerved Microſcopically, n. 173. p. 1080.

Cancer in the Eye cured, n. 167. p. 839.

Canon Precipuarum è ſtellis fixis. See Stars.

Cape of good hope, its Longitude, n. 185. p. 253.

Carduus benedictus, its Salt obſerved by the Microſcope, n. 173. p. 1073.

Cardans Canons their defect ſupplyed, n. 159. p. 577.

Carpets and Mats the Turks chief Furniture, n. 155. p. 444.

Carriages ſeveral ingenious Experiments relating to them, n. 161. p. 666.
Carteſian Philoſophy cenſured, n. 137. p. 939.
Cartilages, Obſervations on them, n. 194. p. 553.
Carvels, what, n. 201. p. 783.
Caſting Statutes very thin, n. 186. p. 259.
Caſtoreum, what, n. 153. q. 377. how cured, n. 193. p. 501.
Cat monſtrous. See Monſters.
Catalogue of Experiments drawn up by Sir Will. Petty, n. 167. p, 849.
Cawſeway Giants, in Ireland, n. 199. p. 708.
Celerity of the *Circulation* of the Blood, n. 191. p. 433.
Ceruſs how made, n. 137. p. 935.
Chamaili, a kind of Amulets or Spells among the Turks, n. 155. 440, 445.
Chalk in the Gout obſerved Microſcopically, n. 168. p. 891.
Chanes in Pruſa, n. 155. p. 433.
Chaos diſcourſed on, n. 196. p. 615.
Characters unknown, a Perſepolis, n. 201. p. 775. at the Hills of Canara, n. 203. p. 203. p. 872. See Chineſe.
Checkerghe. See Bath.
Child monſtrous. See Monſters.
Chickens how hatch'd at *Cairo*, n. 137. p. 923.
Chineſe Character conſidered, n. 108. p. 63. *Chineſe* Abacus, n. 180. p. 66.
Chineſe Wall, n. 180. p. 55. n. 189. p. 378.
Chineſe Calendar and Chronology, n. 189. p. 377. Emperor of *China* his manner of Hunting, n. 180. p. 44.
Chorographick Problems. See Mathematicks.
Chronology not known nor obſerved by the Turks, n. 155. p. 439. See Medails.
Chriſt'nings and Burials. See Burials.
Chryſtalline Humour of the Eyes of a Man, n. 168. p. 889. Of an Horſe, n. 205. p. 955.
Chyle upon what account white, n. 149. p. 242. Its Paſſage not yet demonſtrated, n. 143. p. 6.
Chymiſtry a Conteſt between Mr. *Kuncle* and Dr. *Veight*, n. 168. p. 896.
Cicidela Volans deſcribed, n. 167. p. 841.
Cinnamon of a white ſort, n. 172. p. 1031.
Cinnabar obſerved Microſcopically, n. 200. p. 754.
Cios. n. 155. p. 431.
Circular Magnetical Needle, n. 188. p. 344.
Clays, a Table of their different kinds, n. 164. p. 745.
New way of *Cleaving* Rocks, n. 167. p. 854.
Cloath incombuſtible, n. 172. p. 1049.
Clock aſcendent on an inclined Plane, n. 140. p. 1006.
Clouds paſſing over cauſe Gripings, n. 201. p. 786.
Coals burn the longer the more they partake of the *Pyrites*, n. 157. p. 517.
Cochineel fly, n. 176. p. 1202. what and how cured, n. 193. p. 502.
Coffee-houſes ordered to be ſhut up in Conſtantinople, as places of Idleneſs

Idleneſs and Sedition, n. 155. p. 441.

Coins very coarſe and droſſy among the Turks, &c. n. 155. p. 442. Foreign Coin current with them but not with the Indians and Perſians, ib. Saxon *Coins* found at Honedon in Suffolk, n. 189. p. 356. n. 203. p. 874.

Colon not faſtened to the Meſentery, n. 153. p. 367.

Colours of the Chameleon obſerved, n. 137. p. 930. A Catalogue or Table of ſimple and mixt *Colours*, n. 179. p. 26. Colours how cauſed, n. 142. p. 1074. Airs effect on *Colours*, n. 204. p. 898. Colour of the Arterial Blood whence, n. 204. p. 901. Reds advanced by volatile Salts, n. 204. p. 906.

Comets in 1664, 65, and 77. n. 139. p. 186.

Comet in 1682. n 143. p. 16. In 1683. n. 154. p. 416. In 1684. n. 169. p. 920. In 1686. n. 186. p. 256.

Comier's Problem, which is only doubling the Cube ſhewn the Algebraical way, n. 162. p. 676.

Sea *Compaſs* changing its Poles in a Thunder-ſtorm, n. 158. p. 20.

Concoction explained by Putrifaction, n. 158. p. 529.

Conjunctions. See Planets.

Connough worme deſcribed, n. 168. p. 876.

Congo, Obſervations thereof, n. 139. p. 977.

Conſtantinople, a Diſcourſe concerning it, n. 152. p. 335.

Conſtruction of æquations by a given Parabola, n. 188. p. 335.

Convulſion vid. Diſeaſes.

Copperas how made, n. 142. p. 1054.

Corn trodden out by Oxen, n. 155. p. 444.

Cortex. See Plants and Diſeaſes.

Craven in Yorkſhire, a Catalogue of ſome very aged Perſons in thoſe parts, n. 160. p. 597.

Creatures. See Animalcules.

Cubick æquations. See Algebra.

Culture. See Plants.

Cupels made of calcin'd Bones, n. 158. p. 531.

An under *Current* at the Streights-mouth in the Baltic, and the Downs, a Conjecture about it, n. 159. p. 564.

Cures. See Diſeaſes.

Curves their uſe in æquations, n. 159. p. 581.

Cuſtoms of thoſe of *Hirta*, n. 137. p. 929. Of the Perſians, n. 137. p. 943. Of the People of Good-hope, n. 137. p. 944.

Cuticula ſcaley. See Microſcopical Obſervations and Scales.

D

Damps. See Steams.

Deluge generally diſcourſed of, n. 196. p. 616.

Dervices, a ſort of Religious among the Turks, n. 155. p. 448.

Digeſtion, a Diſcourſe of it, with ſeveral Experiments about it, n. 162. p. 694.

Diſeaſes, incident to the Ceruſs-makers, n. 137. p. 936. *Falling-ſickneſs.* See Worms *Hydrophobia.* See *Hydrophobia* Hyſterical Fits. See Hyſterical. *Diſeaſes* in *Jamaica*, n. 141. p. 1031. *Diſeaſes* cured by the *Bath*, n. 169. p. 944. Caſûs cujuſdam rarioris de Juvene veſpere cæcutiente, Philoſophica ſolutio, n. 166. p. 804. Cancer in the Eye cured, n. 167. p. 839. Periodical *Convulſions*, n. 174. p. 1113. and 1115. Cure for the *Murrain*, n. 145. p. 94. n. 199. p. 699. *Hydatides* in Morbid Bodies, a Species of Worms, n. 193. p. 506. Mercury an Enemy to the *Lungs*, n. 192. p. 486. *Tertian* and other Agues explained, n. 197. p. 659. Agues cured by Sal Vol. Oleo. and by Tee, n. 145. p. 80. Diſorder of the Animal Spirits the Cauſe of moſt *Diſeaſes*, n. 199. p. 717. Of the Cure of *Agues* and *Fevers* by the *Cortex*, n. 199. p. 719. and 722. Diſeaſes in Virginia, n. 201. p. 78. *Gout* not cauſed by Wine, n. 170. p. 979. *Gripings* caus'd by the Clouds paſſing over, n. 201. p. 786. A Propoſal to examine the Weight of *Urine* in *Diſeaſes*, n. 201. p. 794. Obſervations on the Moon's Influence on the Motions of Diſeaſes, n. 202. p. 815. A very great *Stone* voided without cutting, n. 202. p. 817. *Scurvy* cured by the *Cortex Winteranus*, n. 204. p. 924. *Contagious* Diſeaſes communicated by the Air, n. 204. p. 906. The Effect of eating *Dog Mercury*, n. 203. p. 875.

Diſſolution of the World by Fire at laſt, n. 196. p. 617.

Of the *Diviſibility* of Matter, n. 194. p. 540.

Dogs mad how cured; and thoſe bitten by them, n. 187. p. 298. n. 191. p. 408.

Dog Mercury. See Diſeaſes and Plants.

Ducks bred under Ground, n. 191. p. 425.

E

Ears of Fowl how formed, n. 199. p. 714. n. 206. p. 993.

Earth that it is more or leſs hollow from the Experience of Miners, n. 157. p. 512. An Hypotheſis the internal Structure of the *Earth*, n. 195. p. 563. A Propoſal to diſcover the Earth's Motion, n. 202. p. 844. Primæval Earth and Paradice, n. 203. p. 890.

Earthquake at Oxford, n. 151. p. 311. *Earthquakes* of their Nature, the Origine of the Matter of them from the *Pyrites* alone, n. 157. p. 511. One at *Conſtantinople*, Oct. 26. 1669. at *Ancyra* in the leſſer *Aſia* the *Earth* ſhook for 47 Days together, An. 1668. ib.

A diſcourſe of *Earthquakes* particularly in England, Sept 1692. n. 196. p. 617. That in Sicily in Jan. 169$\frac{2}{3}$. deſcribed with an account how they are probably cauſed, n. 202. p. 827. &c. The Cœleſtial Cauſes of them, n. 203. p. 893.

Earthen Veſſels. See Antiquities.

Echos of all ſorts diſcourſed of, n. 156. p. 483.

Eclipſes of the *Moon*, n. 141. p. 1015. n. 143. p. 15. n. 145. p. 89. n. 146. p. 145. n. 162. p. 689. n. 178. p. 1282. n. 182. p. 146. n. 184. p. 206. n. 192. p. 452. n. 185. p. 236. and 252. Of the *Sun*, n. 141. p. 1020. n. 162. p. 691. n. 164. p. 747. n. 189. p. 370. n. 203. p. 858. Of *Jupiter's Satellites*, n. 151. p. 322. n. 154. p. 404. and 413. n. 165. p. 759. n. 177. p. 1215. n. 184. p. 200. n. 191. p. 435. Of *Jupiter* by the Moon, n. 181. p. 86. n. 183. p. 175. 177. n. 184. p. 206. Of *Saturn* by the Moon, n. 139. p. 969. n. 186. p. 370.

Eeles their Scales microſcopically diſcovered, n. 186. p. 893. Thoſe in Vinegar deſcribed, n. 170. p. 964

Eggs, of Egg-branches, n. 145. p. 74.

Eggs in the *Cornua Uuteri* of a Worm, n. 147. p. 157. Eggs affixed to the Meſentery, &c. n. 147. p. 186.

Equations. See Algebra and Geometrical Key.

Elements of *Euclid*, a new and eaſie way of demonſtrating ſeveral Propoſitions therein, n. 162. p. 672.

Elms. See Plants.

Engine to make Linnen Cloth, n. 140. p. 1007.

Entalia and Dentalia, what, n. 197. p. 639.

Experiments of *Poyſon.* See Poyſon. Of *Digeſtion.* See Digeſtion. A Catalogue of ſuch of ſuch as are mean, vulgar, cheap, ſimple, &c. By Sir Will. Petty, n. 167. p. 849. Of Trees. See Plants.

Eyes. Remarkable Diſeaſes in them. See Diſeaſes. Concerning the *Chriſtaline* and *Vitrious* Humours with their difference, n. 165. p. 790. See Chriſtaline. *Sclerotis* in Fowl and Fiſh a Cartilage, n. 199. p. 715. Obſervations on the *Optic Nerve.* See Nerves.

F

Fœtus. See Anatomy and Generation of Animals.

Of the Perpendicular *Fall* of Bodies, n. 179. p. 9.

Falling-ſickneſs accompanied with Worms in the Water, n. 140. p. 1009. and n. 167. p. 839.

De *falſa* Graviditate. See Generation of Animals.

Feathers of Inſects. See Microſcopical Obſervations.

Ferment in the Stomach. See Digeſtion.

Of the *Fibres* of the Optic Nerve. See Nerve.

Numeral *Figures* how ancient in Europe, n. 154. p. 401.

Fire produced by the Mixture of two Liquors actually cold, n. 150. p. 291. See Accenſion. *Fire* in Sepulchral Lamps not perpetual, n. 140. p. 1012. See Lamps. Of the laſt Diſſolution of the World by *Fire*, n. 196. p. 617.

Fiſh paſs twice a Year through the Boſphorus, n. 152. p. 344. Obſervations on the *Purple Fiſh*, n. 178. p. 1278. See Purpura. *Fiſh* under Ground, n. 191. p. 417.

Shell fiſh of an odd Species in the Eaſt-Indies, n. 203. p. 870. See Shells. Eeles. See Eeles. *Scales* of ſeveral *Fiſh*. See Microſcopical Obſervations. *Jack.* See Glands.

Bubbles in *Fluids*, n. 205. p. 960.

Flying Glow-worm. See Cicidela Volans, an Apex under the Wings of *Flies*, n. 198. p. 691.

Flowing and Ebbing Spring. See Spring.

Foci of Glaſſes. See Opticks.

Foot Roman, its meaſure, n. 155. p. 466.

Force of the *Air* ruſhing into an exhauſted Receiver, n. 184. p. 193.

Fortification. See Books.

Fountains, Obſervations on Boiling and other Fountains, n. 169. p. 922. n. 172. p. 1036. Their expence of Water computed, n. 181. p. 122. See Springs.

Fox Hydrophobia cauſed by the Bite of a mad Fox. See Diſeaſes.

Frog-ſpawn, Obſervations thereon, n. 193. p. 523.

Froſt. A Diſcourſe of its effects on Trees, and other Plants, An. 1683. wherein ſeveral material Queries are ſolved explaining the Nature and Force of Cold, n. 165. p. 766. Experiments on *Freezing*, n. 167. p. 836.

Fruit. See Plants.

Furnaces for Refining deſcribed, n. 142. p. 1050.

G

Generation, a Theory thereof, n. 192. p. 468.

Fœtus 26 Years in Utero, n. 139. p. 979.

Generation ſuppoſed to be by an Inſect, n. 174. p. 1120. See Animalcules. Obſervations on the Generation of Frogs, n. 193. p. 523. Of *Impregnation* from a ſubtile Effluvium of the Male ſeed, n. 196. p. p. 613. Obſervations on the Teſticles of Rats. See Teſticles. Of the Ovaries of Females, n. 196. p. 615. Of the *Propagation* of Animals, n. 199. p. 708. Queries concerning *Generation* diſcuſs'd, n. 202. p. 853. No ſpontaneous Generat. ib. The Seeds of all Animals in the Eggs of the Females. ib. Epiſtola de Graviditate falſa, n. 172. p. 1045.

Geometry. See Mathematicks.

Giants Cawſeway in Ireland of natural Stone Pillars, n. 199. p. 708.

The *Scent-Gland* of the Tajacu deſcrib'd, n. 153. p. 373. A Bed of *Glands* in the Stomach of a Jack, n. 162. p. 699. Liver *Glanduloſe* to the naked Eye, n. 178. p. 1266. *Glandula Pinealis* petrify'd, n. 185. p. 228. See Anat.

Glaſs, the way of making it found out accidentally, Pliny, &c. n. 160. p. 617.

Globe, Earl of Caſtlemains, 139. p. 988.

Glow-worm. See Cicindela. *Idea* of *God* declared, n. 137. p. 939.

Gold. See Metals.

Gout not cauſed by Wine, n. 170. p. 979.

De *Graviditate* falſa. See Generation.

Graſs-hoppers a great ſwarm of them in Languedoc. n. 182. p. p. 147.

Gravity Specifick of ſeveral Bodies, n. 169. p. 926. n. 192. p. 488. n. 199. p. 694. See Medicina Hydroſtatica in Books. The Properties of Gravity conſidered, n. 179. p. 3. The Specific *Gravity* of the Air, n. 118. p. 104.

Greatah, a River in Yorkſhire, ſometimes under Ground for about a Mile, n. 163. p. 729.

Gripings. See Diſeaſes.

Gun, an Inſtrument uſed by Miners in cleaving Rocks, n. 167. p. 854. Experiments of trying the Force of *Great Guns,* n. 173. p. 1090. A Problem of great uſe in *Gunnery* ſolved, n. 179. p. 15.

Obſervations on the firing of *Gunpowder,* and the remaining of the Cole Sulphur and Niter, n. 200. p. 754, 757. fired expands it ſelf, 2080 times, p. 759.

Guts the Anatomy of the Slime within them, n. 160. p. 586. A Spiral *Gut* in ſeveral Animals, n. 153. p. 368. See Cæcum Colon, &c.

H

Hæmatites treated of, n. 199. p. 695.

Haggi or Pilgrims to Mecca, n. 155. p. 446.

Hail of extraordinary bigneſs, n. 203. p. 858.

Hair Bones, &c. found in the Ovary, n. 150. p. 283. Of the Structure of the *Hair,* n. 140. p. 1003. Of the Proportion of *Heat* in all Latitudes, n. 203. p. 878. Expanſion by *Heat,* n. 197. p. 650.

Hawks taught to fly at the wild Boar, n. 137. p. 943.

Heads of Birds, Obſervations thereon, n. 199. p. 711. See Anat. Obſ.

Heads of a Treatiſe of Navigation. See Navigation.

Hearing direct refracted reflex'd, &c. n. 156. p. 481. See Sounds.

Herbs. See Plants.

Hermaphrodite, an Account of one from Tholoſe, n. 186. p. 282.

Herſtol, n. 159. p. 577.

Hirta Iſland with the Manners of of the People deſcribed, n. 137. p. 927.

Hiſtoria. See Diſeaſes.

Horns of the Womb, of a Bitch ſtuft with Bones, n. 147. p. 185. *Horn* hanging at the Neck of an Ox, in a Letter from Malpighi, n. 160. p. 601. *Horns* growing on a Girl's Body, n. 176. p. 1202.

Humming Bird. See Birds.

Humours of the Body how made from the Chyle and Serum, n. 159. p. 580.

Hydatides found obſtructing the Ureters, n. 188. p. 332. *Hydatides* in Morbid Bodies a Species of Worms, n. 193. p. 506. *Hydrophobia* deſcribed, n. 147. p. 162. An Account of one cauſed by the Bite of mad Fox, n. 169. p. 916.

Hydrops oculi cured, n. 167. p. 840.

Hydropicus Lumbricus. See Worms.

Hydropic Teſticle, with other Obſervations on an Hydropical Body, n. 140. p. 1001.

Hygroſcopes of ſeveral kinds, as Oil of Vitriol, &c. 156. p. 505. Mr. Molyneux his new one, n. 172. p. 1032.

Hydroſtatical Examination of ſeveral Bodies, n. 192. p. 488. See Books and Specifick Gravity.

Hydroſtatical Method of examining Water as to freſhneſs, n. 197. p. 637.

Hyperbolick Logarithm, n. 159. p. 579. See Algebra.

Hypotheſis of the internal Structure of the *Earth*, n. 195. p. 563.

Hyſterical Fits explained, n. 150. p. 295.

I

Janizaries, in what Bravery they appear when they attend on Chriſtian Ambaſſadors to their Audience, n. 155. p. 446. *Jatzith*; the time in the Evening when all People in Conſtantinople are to go to their Lodgings, n. 155. p. 446.

Yellow-Jaundice why cauſed by the biting of a Viper, n. 144. p. 49.

Jamaica deſcribed with the Diſeaſes there, n. 141. p. 1031.

Ice of freſh Water wherein different from that of ſalt, n. 167. p. 836.

Ject d'eau. See Fountain.

Ignes fatui, and other Meteors in Virginia, n. 201. p. 789.

Imagination and *Inſtance* of its force in Women with Child, n. 188. p. 334.

Indico queres concerning it, n. 193. p. 503.

Ingreſſes of the Planets. See Planets.

Injection of Mercury into the Blood, n. 192. p. 486.

Incombuſtible Cloth, n. 172. p. 1049.

Influence of the Planets. See Planets.

Infinite quantity, a Diſcourſe thereof, n. 195. p. 556.

Inſcriptions, of an Altar found near the Roman Camp, near Mancheſter, n. 155. p. 457. Roman Inſcriptions at Bath, ib. An old one on the Baſis of a Pillar at *Rome*, n. 183. p. 172. See Antiquities.

Inſect. See Generation, Flies, &c.

Inteſtinum Cæcum of its Uſe and Neceſſity in ſome Animals, n. 155. p. 455. See Guts.

An *Inſtrument* for finding the diſtances of ♃ Satellites from his Axis, n. 178. p. 1262. An *Inſtrument* to make Linnen Cloth of it ſelf, n. 140. p. 1007. A *Clock* aſcendent on an inclined Plane, n. 140. p. 1006. Mariner's *Compaſs.* See Compaſs. An

In

Inſtrument to meaſure Time, n. 161. p. 647.

Iron. See Metals. *Ireland.* See Giants Cawſeway.

Itching of the Skin how cauſed, n. 202. p. 838.

Jupiter. See Planets.

Ivory examined Microſcopically, n. 140. p. 1003.

K

Kelp its uſe in Alum-works, n. 142. p. 1054.

Kidney of an unuſual ſhape taken out of a Man, n. 160. p. 601.

Kirckbythore. See Antiquities.

Kuprioli Achmet. See Achmet.

Kuprioli Mahomet had the Charge of the Turkiſh Empire, caus'd his Father a Greek Prieſt to turn Turk, n. 155. p. 436.

L

Lacteal Veins tinged with blew, n. 143. p. 9. A Diſcourſe to prove that they frequently conveigh Liquors that are not white, n. 166. p. 812.

Lacteal and *Lymphatic* Veſſels ſeem to have no Anaſtomoſis for receiving the Chyle, n. 160. p. 589.

Lake of *Cirknitz* accurately deſcribed, n. 191. p. 411. Lake of *Latron.* See Latron.

Laminulæ in the Sculls of Birds, n. 199. 713. n. 206. p. 993.

Lamps Sepulchral of the Ancients, a Diſcourſe ſhewing the poſſibility of their being made ſeveral ways, n. 166. p. 806. One found in a Sepulcher at Rome, n. 185. p. 227. See Sepulchers.

Latitude of Conſtantinople, n. 152. p. 341. n. 178. p. 1295. Of Rhodes, ib. Of Nurenburgh unaltered theſe laſt 200 Years, n. 190. p. 403. *Latitudes* of ſeveral places in Ruſſia, n. 192. p. 454. See Mathematicks.

Latron, a Lake in Egypt of 6 or 7 Acres whence ariſes a great deal of Natron or Nitre, n. 160. p. 613.

Leak of a Ship found out by the means of the Speaking Trumpet, n. 201. p. 782.

Liege. See *Herſtol, Lemons.* See Salt.

Lepers, Obſervations on them, n. 168. p. 892.

Leucippus. See Atomic Philoſophy.

Lice. Poux de Pharaou, a ſort of Louſe, n. 139. p. 979.

Light, Queres concerning it, n. 206.

Light'ning Inſtances proving the Cauſe of it, and that it is Magnetic, n. 157. p. 519. Changes the pointing of a Sea Compaſs, n. 157. p. 520. The effects of it, and Thunder at Portſmouth, n. 177. p. 1212. Storm of Light'ning and Thunder in the Bay of Biſcay, Aug. 12. 1693. n. 204. p. 911.

Lime, Salt of it view'd, n. 173. p. 1084. See Salt. *Limits* in the Roots of ſolid æquations, n. 190. p. 387.

Linnen Cloth. See Inſtruments.

Linum. See Paper.

Liver. See Anatomical Obſervations, and Glands.

Liquor, an Account of a *Self-moving Liquor,* n. 176. p. 1188.

Lodoicea Sidera, n. 181. p. 85.

London bigger than *Paris*, the Number of People and Houſes in London, n. 185. p. 238.

Longitude more likely to be found by the Eclipſes of Jupiter's Satellites than of the Moon, n. 154. p. 406. Longitude of the Cape of Good Hope, n. 185. p. 253. Of Nurenburgh, n. 182. p. 147.

An Arithmetical Paradox in the Chances of *Lotteries*, n. 198. p. 677.

Loughs and Bogs in Ireland, a Diſcourſe of them, n. 170. p. 948.

Lough neagh in Ireland, an Account of its petrifying Qualities, n. 158. p. 554. An Anſwer to ſome Queries concerning it, n. 174. p. 1108.

Lumbricus. See Worms.

Lunaris defectus. See Eclipſes.

Lungs. See Mercury.

Lungs of the Salamandra aquatica, n. 144. p. 30.

Lympha its uſe, n. 149. p. 243.

M

Macreuſe a French Fowl, n. 172. p. 1036. and 1041.

Animals not meer *Machines*, n. 202. p. 853.

Madneſs in Dogs how cured. See Dogs.

Mad Fox. See Fox.

Magia. A Diſquiſition concerning its diviſion into Humane and Diabolical, Natural and Tranſnatural, n. 162. p. 706.

Magnetical compas, a Theory of its variation, n. 148. p. 208. A new ſort of *Magnetical* Needle, with an Hypotheſis thereon, n. 188. p. 344. Obſervations of the reſpect of the Needle to a piece of Iron held, &c. n. 177. p. 1213. An Account of the Variation of the Variation, n. 195. p. 463. *Variation* on the Coaſt of Guinny, n. 159. p. 578.

Mahomet 1ſt, his Sepulcher, n. 155. p. 433.

Mahomed Baſſa in the time of Achmet, the firſt natural Turk made Grand Vizir, n. 155. p. 436.

Mahot Kuprioli. See Kuprioli.

Mahomet the falſe Prophet, with the Veneration the Turks pay to any Relique of his, his Banner, &c. n. 155. p. 440. and 448.

Maize. See Plants.

Malt. See Plants.

Mankind how beſt increaſed, n. 198. p. 656.

Mantle-Tree, with Numerical Figures, n. 154. p. 399.

Map, a Propoſal for a new ſort, which ſhall contain the different Soils of each Country, n. 164. p. 739.

Map of Tartary, n. 193. p. 492.

Marrow, its uſe to the Bones, n. 194. p. 548.

Matter, its Diviſibility, n. 194. p. 540.

Mathematicks little underſtood or regarded by the Turks, n. 155. p. 438. Concerning the Collection of *Secants* and the true diviſion of Meridians in Sea-Charts, n. 176. p. 1193. *Latitude* of Places. See Latitude and Longitude. *Aſtronomical* Obſervations. See Aſtronomy and Planets. Earl of Caſtlemain's main's Globe, n. 139. p. 988. *Geometry.* See Maps. Mathematical Paradoxes. See Paradoxes. Of the Earth's Motion. See Aſtronomy and Paralax. The Florentine Problem of the Quadrable Arched Roof, n. 196. p. 584. The Solution of three Chorographical Problems, n. 177. p. 1231. *Solid Problems.* See Solid.

Medails. See Coins and Books.

Medicina. See Diſeaſes and Books.

Memory the ſtrength of it when applied with due attention, n. 178. p. 1269.

Mercurial Standard. See Barometer.

Mercurius in ſole. See Planets.

Meſaraic Veſſels, n. 153. p. 368.

Metals. The Art of Refining them, n. 142. p. 1046. Why *Metals* ſwim in corroding *Menſtrua*, n. 181. p. 88. Mercury an Enemy to the Lungs, n. 192. p. 486. Hydroſtatical Examination of ſeveral *Metals.* See Hydroſtaticks. *Gold* its thickneſs upon Gilt Wyar, n. 194. p. 540. *Gold* how Refined with *Antimony*, n. 138. p. 953. *Iron-works*, and Ore in the Foreſt of *Dean* deſcribed, n. 137. p. 931. Iron Ore, Hæmatites and Iron-works deſcribed, n. 199. p. 694. Digging and preparing *Lapis Calaminaris*, with the making of *Braſs* out of Copper, n. 198. p. 672. n. 200. p. 734. Steel, n. 199. p. 695. n. 203. p. 865. *Tinmines* Works and Ore in Cornwall deſcribed, n. 138. p. 949.

Bell-metal, Gun-metal and *Pot-metal* wherein their difference, n. 200. p. 736. See Mines.

Meteors. See ignes fatui.

Microſcopes, ſingle ones how made, n. 141. p. 1026. A Deſcription of Microſcopes, n. 139. p. 987.

Microſcopical Obſervations on the *Teeth*, n. 140. p. 1002. On the Grain of *Ivory*; and Structure of the *Hair*, n. 140. p. 1003. *Animals* in Pepper-water. See *Animals.* On the *Fleſhy Fibres*, On the *Feathers* of the Wings of Inſects. On the Bloodglobules, *&c.* n. 145. p. 80. On *Animals* in the Scurf of the Teeth, Worms in the *Noſe* and Scaleyneſs of the *Skin*, n. 159. p. 568. On the *Brain*, n. 168. p. 883. On the *Chryſtalline* Humour of the Eye, n. 168. p. 889. n. 197. p. 646. and n. 205. p. 955. On *Moxa*, n. 168. p. 890. On the *Chalk* in the Gout, 891. On Salts. See Salts. On the *Seeds* of Plants. See Plants. Of the *Texture* of *Wood.* See Wood and Plants. Of the *Slime* and *Scales* of Fiſh, and Scales on the Skin, n. 186. p. 893. n. 205. p. 956. of *Vinegar* Eeles, n. 170. p. 964.

Milium of Guinee deſcribed, n. 172. p. 1031.

Minerals, thoſe that are Sulphureous are wholly or in part Pyrites, n. 157. p. 513. Some inflamable beſides the Pyrites, ib. p. 515. Mineral Waters. See Waters.

Tin *Mines* in Cornwall deſcribed, n. 138. p. 949. Alum Mines, n. 142. p. 1052. Of the *Mines* of *Lapis Calaminaris*, n. 198. p. 672. Queries and Anſwers as to *Copper* Mines, n.200.p.737. See Metals.

Moles, Obſervations on their Heads, particularly the Ears, n. 206. p. 993.

Monſons in the Indian Seas, their Hiſtory, and Cauſe inquired, n. 183. p. 158.

Monſters. A *monſtrous* Birth at *Petworth* in Suſſex, n. 138. p. 961. A *monſtrous* double *Cat*, n. 174. p. 1135. A Girl with Horns on her Body, n. 176. p. 1202. Two monſtrous *Births*, at *Aberdeen*, n. 175. p. 1156. *Hermaphrodite.* See Hermaphrodite. Monſtrous Child in *Jutland*, n. 160. p. 599.

Montanea. See Cios.

Moon. See Planets, its effect on Diſeaſes, n. 202. p. 815.

Monuments. See Antiquities.

Morad, 1ſt. and 2d. their Sepulchers, n. 155. p. 432. *Morad* 3d. his Cruelty, p. 453.

Mortality. See Burials.

Moſchs, n. 155. p. 124.

Movement, a peculiar one to meaſure Time, n. 161. p. 647.

Mountain of a vaſt heighth in *China*, n. 180. p. 59. *Ararat* hid in the Clouds for three Months, n. 137. p. 942. The uſe of the *Mountains*, n. 196. p. 615. Burning *Mountains.* See Volcanos.

Mouths in the Joynts of the Lumbricus latus, n. 146. p. 132.

Moxa, the Production of a Fruit like the Down on a Peach, Cotton its beſt Succedaneum, n. 168. p. 890.

Mufti among the Turks, n. 155. p. 448.

Murren. See Diſeaſes.

Muskcods, not the Teſticles, n. 153. p. 377.

Muſcle Spiral in the Earth-worm, n. 147. p. 155. Muſcles and Tendons deſcribed, n. 194. p. 550.

Muſical Room, how one might be contrived ſo that one Inſtrument ſhould make a Conſort, n. 156. p. 486.

Muſical Notes of the Trumpet-marine, n. 195. p. 559. A Conjecture at the Tempers of Perſons from the Muſicalneſs of the Voice, n. 140. p. 1010.

N

Natron. See Latron.

Navigation, not much minded by the natural Turks, their Compaſs conſiſts but of Eight Points. Side Winds of no uſe to them, n. 155. p. 439. Heads for a Treatiſe of *Navigation*, n. 198. p. 657.

Needle. See Magnet.

Nerves, Fibres of the Optic Nerve how capable of Tenſion, n. 147. p. 175. Obſervation of the Optic Nerve, n. 205. p. 955.

Nerves in the Bills of Water Fowl, n. 199. p. 714. n. 206. p. 990.

Neurographia. See Books.

Neuruz, or New Year of the Turks. See Year.

Nicopolis. See Cios.

Nitre, ſo call'd from Nitria in Ægypt, its Principles and their Riſe, its uſe in Phyſick agriculture, *&c.* wherein it differs from Sal Armoniac, &c. n. 160. p. 609. See Salt-peter.

Noſe, its Structure, n. 139. p. 977.
Nammaria. See Books.
Nurenburg, its Longitude. See Longitude.

O

Oaky-Hole, n. 157. p. 513.
Objects. See Teleſcopes.
Obſervations. See Planets.
Obſervations in the Practice of Phyſick, n. 167. p. 839. *Obſervations* Anatomical. See Anatomy. Microſcopical. See Microſcopes.
Oculi cancer. See Diſeaſes.
Opticks, the Problem of finding the Foci of all Glaſſes, n. 205. p. 960.
Ore. See Minerals.
Orpiments poyſonous, tho' all Gold Ores, n. 157. p. 515.
Ornithology, Particulars to be added to it, n. 175. p. 1159.
Os frontis very large, n. 168. p. 880.
Otacouſticks. See Hearing.
Ovary. See Eggs, Generation, and Hair.
Oil of Vitriol, whence the increaſe of its weight when expoſed to the Air, n. 156. p. 496.

P

Palſie. See Diſeaſes.
Paper, a ſort made of Linum Aſbeſtinum, n. 166. p. 800.
Papin's Engine for raiſing Water defended againſt Mr. *Nuis*, n. 186. p. 263.
Paradice, and Primæval Earth, n. 201. p. 811. n. 203 p. 890.
Paradoxes in ſeveral Sciences, n. 198. p. 677.
Paralax of the fixt Stars to diſcover the Earth's Motion, n. 202. p. 844.
Paralax of the Moon how beſt obſerved, n. 141. p. 1034.
Pearl fiſhing in Ireland, and ſome of great Value found there, n. 198. p. 659. Tranſparent Pearl, n. 137. p. 943.
Pen Park-hole in Glouceſterſhire, n. 143. p. 2.
People of London how many, n. 185. p. 238.
Pepper Water Animalcules. See Animalcules.
Periodical Bleeding at the Fingers, n. 171. p. 989.
Perpetual Motion, a Diſcourſe concerning it, n. 177. p. 1240. Refuted, n. 182. p. 138. and n. 186. p. 267.
Petrified Glandula Pinealis, n. 185. p. 228. Petrifications. See figured Stones.
Philoſophy Atomic diſcourſed of and defended, much older than *Democritus* or *Leucippus* who were the firſt Atheizers of it, n. 137. p. 937. *Des Cartes Philoſophy* cenſured, n. 137. p. 939. The Pagan Theogony, a Coſmogony. ib. Of the ancient State of *Philoſophy*, n. 201. p. 796.
Phoſphorus like Light'ning, n. 150. p. 289. How made by Mr. *Boyle*, n. 196. p. 583.
Phyſick how practiced by the Turks, n. 155. p. 437.

Phyſical Obſervations, n. 167. p. 839.

Pillars of Porphyry in Egypt, n. 161. p. 624. and n. 178. p. 1252.

Pillars of the Giants Cawſeway. See Giant.

Pine. See Plants.

Pinealis. See Petrification.

Pimienta. See Plants.

Pituita its uſe, n. 142. p. 1072.

Plague got but by Infection, n. 165. p. 790.

Planets. Eclipſes of the Planets. See Eclipſes. Tranſit of Mercury under the Sun, n. 141. p. 1033. and n. 192. p. 483. How to obſerve the *Moon*'s Paralax, n. 141. p. 1034. Theory of the *Moon* moſt defective, ib. of Jupiter's Satellits. See Eclipſes, and Inſtruments. Two new Satellits of Saturn diſcovered, n. 181. p. 79. and 187. p. 299. Occultation of Saturn by ☽ n. 139. p. 969. Jupiter's Geocentrick place for the Year, 1687. n. 184. p. 204. Three *Conjunctions* of *Saturn* and *Jupiter* calculated, n. 149. p. 244. How many poſſible in one Year, n. 149. p. 247. De tribus *Conjunctionibus* magnis, n. 151. p. 325. Ingreſſes of *Jupiter*'s Satellits into his Shadow, n. 151. p. 322. Conjunction of *Mercury* and *Venus* with the Sun, n. 193. p. 511. Tables of the Motions of the 5 *Satellits* of *Saturn*, n. 187. p. 301. Spots in the *Sun*, n. 157. p. 535. *Sun* why it appears bigger near the Horizon, n. 187. p. 314.

Plants in Brazeil whoſe Leaves are large enough to cover a Man, n. 139. p. 978. *Sorbus pyriformis* deſcribed, ib. *Kelp* its uſe in Alum-works, n. 142. p. 1054. *Maize* its deſcription, n. 142. p. 1065. planted in Ireland, n. 205. p. 928. *Plants* of Perſia, n. 137. p. 943. *Saffron* how ordered, n. 138. p. 945. *Malt* how made in Scotland, n. 142. p. 1069. Experiments concerning the Growth of *Trees* by Mr. Brotherton, n. 187. p. 307. of the Art of Pruning of *Fruit*-Trees, n. 163. p. 733. *Milium* of Guiney deſcribed, n. 172. p. 1031. The moſt ſeaſonable time for felling *Timber*, n. 192. p. 455. beſt if barkt the Year before, p. 457.

Pimienta or *Jamaica Pepper*-Tree deſcribed, n. 192. p. 462. Suppoſed *Cortex Winteranus* deſcribed, ib. Jeſuits Bark. See Diſeaſes. *Silver-pine* with another Species of Pines deſcribed, n. 198. p. 665. *Virginia* Plants, ib. p. 169. *Seeds* of Plants. See Seeds. *Truffles* found in Northamptonſhire, n. 202. p. 824. *Texture of Wood.* See Microſcopical Obſervations and Wood. True *Cortex Winteranus* deſcribed, n. 204. p. 922. Obſervations on the Planting of *Tobacco*, and of its ſeveral ſorts, n. 205. p. 943. and n. 206. p. . A hint at a Method of conjecturing at the Vertues of Plants, n. 205. p. 944. Embrio Plants in the Seed. See Microſcopical Obſervations and Seeds. Effects of eating *Dog-Mercury*, n. 203. p. 875. Of the Propagation of *Elms* by Seed, n. 205. p. 971. Continuation of the *Species* of *Plants* from a *Plaſtic* nature,

nature, n. 196. p. 612. Why Water-Plants grow flat, ib. p. 611. no Plants at great depths in the Sea and why, n. 196. p. 615. *Sampire.* n. 156. p. 494.
Pliny, Emendations of him, n. 194. p. 535.
Polypus in the Heart, its Cauſe, Effects and Cure, n. 158. p. 548.
Pont Eſprit. See Bridg.
Pools hole, n. 157. p. 513.
Pores in the Skin, their Figure and Uſe, n. 159. p. 566.
Poroſity of Bodies. See Books.
Porphyry Pillars. See Pillars.
Pot-aſhes examined microſcopically, n. 173. p. 1078.
Powder. See Guns.
Poyſons. See Orpiments. Poyſonous bites. See *Teeth.* Experiments of the Poyſons of ſeveral Serpents ſhewn by an Indian, n. 144. p. 49.
Preſſure. See Sea.
Prieſts of Mahomet may be Seculars when they pleaſe. See Derviſes.
Primer univerſal, n. 182. p. 134.
Primeval Earth, n. 203. p. 890.
Problem. See Mathematicks.
Proceſs verbal on an ancient *Gauliſh* Sepulcher, n. 185. p. 221.
Proboſſis of Bees, n. 175. p. 1158.
Projectiles their motion in a Parabola, made out, n. 179. p. 11.
Pruſa in Bithinia, n. 155. p. 431.
Puniſhments for Robery, Murder, &c. among the Turks, n. 155. p. 443.
Purple-fiſh, Obſervations on it, n. 178. p. 1278. Purpura of the Ancients, n. 197. p. 644.
Pyrites, wholly Sulphur, takes fire of it ſelf is the only known Mineral yielding an inflammable Vapour, the probable Cauſe of Damps in Mines, Earthquakes, Thunder, &c. n. 157. p. 512. Sulphur ſublimed from *Pyrites* in Ætna, n. 169. p. 924.

Q

Quadratic Æquations. See Æquations and Algebra.
Quadrature of Figures comprehended by curve and right Lines improved, n. 183. p. 186.
Quantity of *Vapour* raiſed out of the Sea by the Sun, n. 189. p. 366. A Diſcourſe of infinite Quantity, n. 195. p. 556.
Quickſilver, a Diſcourſe concerning its Motion in the *Barometer*, Whether its great Riſe in froſty Weather is any ſign either of an healthy or ſickly Seaſon? Its natural State whether when expanded? Whether great Froſts as well as great Warmth will not bring it nearer to its own Nature? Whether the Humours of our Body are not after the ſame manner affected? The Plague and other Exotic Diſtempers not cauſed by the Weather but by Infection, n. 165. p. 790. &c. See Barometer.
Quickſilver hurtful to the Lungs, n. 192. p. 486. its uſe in Refining, n. 142. p. 1052.
Quinet what it is, n. 167. p. 854.

R

Rain, that it rained in ſome places Iron, *Copper*, Stones, why thoſe and not Silver or Gold, n.157. p. 518. *Raining* of *Wheat* in *Wiltſhire*, n.186. p.281. Raining of Brimſtone. See Brimſtone.

Raiſing Water, a new Way propoſed, n. 173. p. 1093. explained, n. 177. p. 1238. and n. 178. p. 1254. with its full deſcription, n. 178. p. 1274.

Receipts for mad Dogs. See Dogs.

Refining the Art, n. 142. p.1046.

Reſiſtance of the Air to Bodies meaſured, n. 186. p. 269.

Reſpiration how made with its uſe, n. 142. p. 1072.

Rivers, their number in Virginia, the Reaſons of ſo few Towns there, n. 201. p. 792.

River *Greatah*. See Greatah and Water.

Rocks, a new way of cleaving them, n. 167. p. 854.

Roots, their number in Cubic and Biquadratic æquations, n. 190. p. 387.

Rock Plants a farther account of them, n. 150. p. 276.

Ruines of a *Roman Wall* deſcribed, n. 147. p. 238.

Ruminating Man, n. 193. p. 525.

Runic Inſcriptions, n. 178. p.1287. and 1291.

S

Saliva. See Pituita and Books.

Salts. A *Salt-plain* of 12 Hours riding, n. 137. p. 942. *Salt-ſprings* at Droytwich in Worceſterſhire, n. 142. p. 1059. Sand in *Salt-brine*, n. 145. p. 97. Microſcopical Obſervations on the Salts of Wine and Vinegar, n. 170. p. 963. n. 205. p. 958. on thoſe of ſeveral oother Subſtances, n. 173. p. 1073. Of thoſe of Juice of *Lemons* Sal Armoniac and Sal Vol. Oeo. n. 205. p. 858. &c.

Salt-peter obſerved microſcopically, n. 173. p. 1075. Queries concerning Salt-Petre, n. 193. p. 503.

Salt-peter a very fixt Salt, n. 204. p. 904.

Salt Armoniac and Soda, or Potaſhes obſerved microſcopically, n. 173. p. 1089. Salt of *Ambar* no Volatile Salt, n. 204. p.905.

Saltneſs and freſhneſs of Water examined, n. 197. p. 627. and 637. A *ſtandard* of Salts, n. 204. p. 904. *Volatile Salts* advance red Colours, n. 204. p. 906. *Salts* in the *Sweat* after drinking Wine obſerved microſcopically, n. 205. p. 954. Of the Difference between *Sea-ſalt* and common Salt, n. 156. p. 489. 492. *Salt-ſprings* Midland of Worceſterſhire, Staffordſhire, Cheſtire, n. 156. p. 489.

Sampire, n. 156. p. 494.

Sandals found in *Weſtmoreland* for Men, Women, *&c.* n. 158. p. 558.

Sand, a Table of ſuch as are found in the North of England, n. 164. p. 743. One ſort whereof is true *Tarſo* of which the Venetian Glaſs is made, n. 162. n. 742.

Virginia black *Sand* Experiments made thereon, n. 197. p. 624.

Sargoſſe, or Lenticula marina, n. 156. p. 494.

Satellits. See Planets and Eclipſes.

Saturn. See Planets.

Saxon Coins found in Suffolk, n. 189. p. 356. See Coins.

Scales on the Skin, n.159. p.568. n. 202. p. 841. Scales within the Mouth, n. 159. p. 580.

Sceleton of the Tajacu deſcribed, n. 153. p. 380.

Scent-bags, n. 144. p. 38.

Scotia illuſtrata. See Books.

Sclerotis in Fiſh and Fowl, a particular Cartilage, n. 199. p.715.

Sea-water how made ſweet, n.156. p. 489. that it was probably the only Element of Water created at firſt, &c. p.493. Sea Larks. See Ornithology. Seas preſſure at great depth, n. 193. p.504. n. 204. p. 908.

Seeds of Aſh and other Plants microſcopically examined, n.199. p.700. Of Cotton, Palm, &c. with Diſcourſes of the Embrio Plant, n. 205. p. 949.

Seeing vide Viſion.

Self-moving Liquor, n.176. p.1188.

Self-opens, or Cavities in the Earth, n. 157. p. 512.

Seminal Principle ſpecifies new acquired Parts, n. 156. p. 497.

Gauliſh Sepulcher found near the River *Eure* in *France*, n. 185. p. 221. Sepulchral *Lamps.* See *Lamps.*

Serpents 25 Foot long, n. 139. p. 978.

De *Seſtertio* diſſertatiuncula, n. 190. p. 384.

Shell Fiſh diſtinguiſht into univalves livalves and turbinated, n. 156. p. 507.

A *Shell* found in the *Kidney*, n.171. p. 1018. Odd Eaſt-Indian *Shell Fiſh*, n. 203. p. 870. Of the *Entalia Dentalia* and Blatta, *Byzantina* and purpura, n. 187. p. 639. See *Purple.*

Shells found under Ground, n.205. p. 941.

Sipho Wurtemburgicus imitated by Mr. *Davis*, n. 167. p. 846. by Dr. *Papin*, p. 847. A Letter concerning it from Dr. *Reiſelius*, n. 178. p. 1272.

Skin. See *Scales*, cauſe of its itching, n.202. p. 843.

Sculls of Fowl deſcribed, n. 199. p.713. n. 206. p. 194.

Smelling, the Reaſon of its delicacy, n. 139. p. 977. See Noſe.

Smoak conſuming Engine, n. 181. p. 78.

Snake, *Rattle-ſnake* Anatomized, n. 143. p. 25. Snake-ſtone its Vertue, n. 144. p. 50. See Serpent. Snake-ſtones. See *Stones.*

Snails of *Virginia*, n. 198. p. 671.

Diſcourſe of Snails, n. 139. p. 983.

Snow bloody or red, n. 139. p. 976.

Soda Salt of *Engliſh Soda* viewed microſcopically, n. 173. p.1087. and that from *Britany*, p. 1088. that from *Alicant*, p. 1089.

Soil of Virginia Diſcourſe thereof, and the manner of cultivating it, n. 205. p. 941. and n. 206. p. 184.

Solar Eclipſes. See Eclipſes.

Solid Problems conſtructed, n.188. p. 335.

Sorbus pyriformis, n. 139. p. 978.

Sounds. An Introductory Eſſay concerning the Doctrine of them, containing ſome Propoſals for the Improvement of Acouſtics; comparing that Science with Optics. Hearing with Viſion. Each divided into direct refracted and reflexed. Three ingenious Problems to this purpoſe. Sonorous Bodies ought to be placed near a ſmooth Wall, Water, &c. n. 156. p. 471.

Spaws (Sulphur) of the ſame nature with Brine-Pits, n. 156. p. 491.

Specific Gravity of ſeveral Bodies. See Gravity.

Speaking Trumpet deſcribed, n. 141. p. 1027. uſed to diſcover the Leak of a Ship, n. 201. p. 783.

Spleen morbid, n. 194. p. 543. See *Stentero phonicon.*

Spectacles without Glaſſes by the help of ſhort Tubes, n. 156. p. 474. with Glaſſes and the ſeveral ſorts of them, n. 156. p. 481.

Speculum Plane, Convex, Concave, n. 156. p. 484. See Optics.

Sperma ceti, what, n. 205. p. 974.

Spiders, n. 139. p. 982.

Spirits Animal, their diſorder the cauſe of moſt Diſeaſes, n. 199. p. 717.

Spirit of Wine grows warm upon the addition of Water, n. 168. p. 898. diſſolves Chryſtals of Silver and coagulates Milk, p. 902.

Springs (one ſalt another Medicinal) on the Banks of the River Weare in the Biſhoprick of Durham, n. 163. p. 726.

Cauſe of *Springs*, n. 192. p. 468.

Stars fixt their Longitudes, Latitudes, right Aſcenſions and Declinations, n. 159. p. 569.

Statutes how caſt very thin, n. 186. p. 259.

Steams ſubterraneous, Obſervations on them, n. 169. p. 922.

Steel. See Metals.

Stentero phonicon, or Speaking Trumpet, n. 156. p. 481. See Speaking Trumpet.

Three *Stomachs* in the Tajacu, n. 153. p. 365.

Stones figured, n. 139. p. 985. *Snake-ſtones* commonly found in Alum-Mines, n. 142. p. 1052. *Stone-powder.* See Sand. *Formed ſtones* found at Hunton in Kent, thought to be of that ſort call'd Conchites, a kind of Marble, ſuch as is dug about Bluckley in the Wild of Kent, n. 155. p. 463. A *Stone* growing to an Iron Bodkin in the Bladder of a Boy, n. 168. p. 882. Stones voided by Seige, n. 170. p. 961. n. 181. p. 94. and n. 182. p. 140. A large *ſtone* taken out of the Bladder of a Man, n. 171. p. 1015. *Stones* voided *per penem*, n. 175. p. 1162. A large *Stone* voided by a Woman *per meatum urinarium*, n. 178. p. 1269. The means of extracting them ſo without cutting, n. 202. p. 817. See *Calculus humanus.* A Deſcription of Stones ſuppoſed to be in Fieri, on the River Don, n. 175. p. 1157. A ſtrange Tincture given to a Stone without Fire, n. 179. p. 22. Arms of *Stone* found buried in France, n. 185. p. 223. *Stone Pillars* of the *Giants Cawſeway* in the Country of *Antrim* in Ireland, n. 199. p. 708. Deſcription of ſeveral *figured Stones*, n. 200. p. 746. *Petrified Teeth* and Bone of a Whale, n. 205. p. 942. *Figured Stones* call'd Brontiæ læves pellucidæ, n.201. p. 778. See Rock Plants.

Storm of Thunder and Light'ning on the Coaſt of New-England, n. 157. p. 519. At *Portſmouth*, n. 177. p. 1212. At *Oundle* in Northamptonſhire, n. 199. p. 710. in the *Bay* of *Biſcay*, n. 204. p. 911. *Storm* of very large of *Hail*, n. 203. p. 858.

Structure of the *Noſe* and Smelling, n. 139. p. 977. Of the *Structure* of the *Parts* of the Body for their ſeveral uſes, n. 196. p. 614.

Sugar made of the Juice of the Maple in Canada, n. 171. p. 988.

Sulphur ſublimed from the Pyrites in Mount Ætna, n. 169. p. 924. See Brimſtone.

Sun an account of the Spots ſeen in it from the 25*th* of April to the 8*th* of May, 1684. n. 157. p. 535. Why the *Sun* appears ſo big near the Horizon, n. 187. p. 314.

T

Table of the mean Conjunctions of Saturn and Jupiter, n. 149. p. 258. Of the mean Motion of the Satellits of Saturn, n. 145. p. 85. A *Tide Table* for the Year 83. n. 143. p. 10. *Tide Tables* in Almanacks falſe, p. 12. Tide Tables reducible to any parts in England, n. 143. p. 14. A *Tide Table* for the Year 1684. With Directions to apply it to any Port in England, n. 155. p. 458. Another for the Year 1685. n. 166. p. 822. Another for the Year 1686. n. 177. p. 232. Another for the Year 1687. n. 185. p. 232. Another for the Year 1688. n. 191. p. 428. A Table of the Deaths of People, with the Values of Annuities for Lives, n. 196. p. 596.

Tajacu and Tiger at Enmity, with the Anatomy of the former, n. 153. p. 363.

Tanning of Buck-skins in Virginia and Carolina, n. 194. p. 531.

Tartar, its Salt obſerved microſcopically, n. 171. p. 1077.

Poyſonous *Teeth* of the Viper-kind deſcribed, n. 144. p. 45. Obſervations on the *Teeth* of Animals with the Scurf thereon. See microſcopical Obſervations.

Teleſcopes Borelli's diſcourſed on, n. 140. p. 1005. Why one with four Glaſſes ſhews objects erect, n. 183. p. 169. See Opticks and Perſpective-Glaſſes.

Tempers and Diſpoſitions of People how gueſs'd at by the Modulations of the Voice in ordinary ſpeaking, n. 140. p. 1010.

Tendons deſcribed, n. 194. p. 550.

Teſt of Refiners how made, n. 142. p. 1049.

Teſticles. See Anatomical Obſervations.

Thea, the Drink made thereof. See Books.

Theoria Telluris ſacra. See Books.

Thermometers how aſcertained, n. 197. p. 650.

Thunder, its cauſe probably from the Pyrites, n. 157. p. 518. Thunder-ſtorms. See Storms. A Man kill'd by Thunder ſtood

ſtood in the ſame Poſture dead as before, n. 201. p. 787.
Tide Tables. See Tables. Tides at Tonqueen. See Tonqueen.
Tin the manner of pulverizing it, n. 175. p. 1183.
Tobacco Obſervations on the Planting it, n. 205. p. 944. n. 206. p. 986. See Plants. It's Oil good for inveterate Sores, n. 205. p. 944.
Tonqueen, an account of the *Tides*, with a Theory of them, and Directions for coming over the Bar there, n. 162. p. 677.
Tortoiſe, a kind of Plant Animal, not being able to bury it ſelf deep enough was kill'd by a great Froſt, n. 159. p. 562. Its weight before and after Winter, n. 194. p. 533.
Trade Winds. See Winds.
Trees their Growth explained, n. 187. p. 307. See Plants.
Truffles found in Northamptonſhire, n. 202. p. 817.
Trumpet ſpeaking. See Speaking.
Trumpet Marine, its Muſical Notes explained, n. 145. p. 559.
Tunking. See Tonqueen.
Turkmans, an account of their wand'ring ſort of Life with their numerous Flocks and Herds, n. 155. p. 447.
Turks, their natural Temper, Manners, Zeal in War, Behaviour after Victory, &c. n. 155. 440. Unskilfulneſs in Sciences. See Mathematicks; as alſo in Huſbandry and Gardening, p. 444. 447. Their Superſtition, ſaluting their Emperors after the manner of the ancient Greeks and Romans, their Government perfectly Arbitrary, p. 449. Grand Seignor's manner of giving Audience to Ambaſſadors of Chriſtian Princes, p. 452.
Turnep Bread how made, n. 205. p. 970.

U

Valves in the Veſſels of Wood, n. 148. p. 201.
Value of Roman Monies compared with the Engliſh, n. 190. p. 385. Value of Annuities for Lives, n. 196. p. 602.
Vapours, ſigns when they riſe, n. 171. p. 993. See Steams. How much *Vapour* raiſed by the Heat of the Sun, n. 189. p. 366.
Variation of the Magnetical Needle at *Siam*, n. 185. p. 252. in Leaotum to the North Eaſt of China, n. 180. p. 41. See Magnetical Obſervations. An Hypotheſis of the Variation of the Variation, n. 195. p. 563.
Veſica fellea wanting in the Mexican Hog, n. 153. p. 368.
Veſiculæ Seminales of more ſorts than one, n. 153. p. 370.
Veſſels. See Antiquities.
Vinegar Salts therein. See Salts.
Vipers biting cauſes the Yellow Jaundice, n. 144. p. 49.
Virginia deſcribed, as to its *Air*, n. 201. p. 783. Sickneſſes, p. 784. ſubject to Thunder, p. 787. Of its Waters, p. 790. Number of its Rivers the cauſe of ſo few Towns, p. 792. Of its Earth and Soil, n. 205. p. 941. n. 206. p. 985. Of its Horſes being work'd without ſhooing, n. 205.

n. 205. p. 941. Of its Plants, p. 942. n. 206. p. 981. Of its Birds, p. 888.

Viſion, a Diſcourſe thereon, in Reference to Brigg's, n. 147. p. 171.

Viſion, two extraordinary Caſes, 1. Of one ſeeing very well in the Day but quite blind in the Night, and of another that thro' ſome Diſtemper in the Head ſaw double, n. 159. p. 559.

Vitriol (Oil.) See Oil. A blew ſort obſerved microſcopically, n. 173. p. 1076.

Vizir. See Achmet and Mahomet.

Ulcus in Inguine dextro inteſtinorum fæces emittens, n. 176. p. 1204.

Voice, its Modulations in ſpeaking indicates the Temper and Diſpoſition, n. 140. p. 1010.

Voyage of the Emperor of *China* into *Corea* and *Eaſt Tartary*, n. 180. p. 39. into *Weſt Tartary*, p. 52. Voyage into Perſia by Tavernier, n. 137. p. 942.

Ureters inſerted into the *Rectum*, n. 147. p. 189. *Ureters* obſtructed by *Hydatides*, n. 188. p. 332.

Vulcano's in probability made up in great part of Pyrites, naturally kindled of themſelves, n. 157. p. 516.

W

Wall of *China* deſcribed, n. 180. p. 55.

Water, high Waters nearer to the Neaps, the leaſt to the higheſt Spring-Tides, n. 143. p. 13. A new way of *raiſing Water*, n. 173. p. 1093. n. 178. p. 1274. n. 186. p. 263. Methods of examining Waters as to freſhneſs and ſaltneſs, n. 197. p. 627. Expanſion and Contraction of Fluids by heat and cold, n. 197. p. 650. The Water of Virginia requires more Malt, n. 201. p. 793. *Wells.* See Springs and Wells. *Water-Plants* why flat, n. 196. p. 611.

Mineral-waters, Queries whereby to examine them, n. 166. p. 802.

Weather-cock, whether one may not be contrived to whiſtle with an ordinary blaſt of Wind to be heard afar off, n. 156. p. 487. Obſervations on the Weather for a whole Year, n. 169. p. 932. A Diſcourſe concerning the Weather, n. 171. p. 991.

Wells. See Spaws and Springs. A Well ebbing and flowing often in an Hour, n. 204. p. 909.

Whales, their ſeveral ſorts, and Whalebone what, n. 205. p. 972.

Wheat ſaid to have fall'n in Rain in Wiltſhire, n. 186. p. 281.

Wheeles, a Diſcourſe proving the larger they are the more eaſily are they drawn over Stones, &c. n. 167. p. 856.

Whiſpering places whence cauſed, n. 156. p. 477.

Wind-pipe of the Rattle-ſnake deſcribed, n. 143. p. 29. Of the Cauſes of ſeveral *Winds*, n. 175. p. 1148. *Winds* Tropic or Trade Winds, their probable material cauſe, n. 156. p. 489. Obſervations on the Winds for the Year 1684. n. 169. p. 932.

Trade-winds between the Tropicks conſidered, n. 183. p. 153. How blowing in the Atlantic and Ethiopic Oceans, p. 154. in the Pacific Sea, p.161. Their Cauſes inquired, p. 164. The Variableneſs of the Winds the cauſe of the riſing and ſinking of the Barometer, n. 181. p. 111.

Windgun by Rarefaction of the Air, n. 179. p. 21.

Wine, its Salts examined. See Microſcopical Obſervations and Salts.

Winter, what Damage the Fruit and other Trees received by the great Froſt, Anno. 1683. n. 159. p. 559.

Womb of its Structure by Dr. Malpighius, n. 161. p. 630. Horns of a Bitches Womb ſtufft with Bones, n. 147. p. 185.

Women amongſt the Turks how they ſet off their Beauty, their chief Diverſion, n. 155. p. 444.

Of the Texture of Wood, n. 202. p. 838. See Plants and Valves.

World, its laſt diſſolution by Fire, n. 196. p. 617.

Worms ſeen in the Water of a Perſon ill of the Falling-ſickneſs, and how cured, n. 140. p. 1009. and n. 167. p. 839. The Conough Worm deſcribed, n. 168. p. 876. *Lumbrici lati*, n. 146. p. 113. *Teretes*, n. 147. p. 154. Hydropicus. See Hydatides. Powder of Worms not to be given, and why, n. 147. p. 159.

Wormwood, its Salt obſerved microſcopically, n. 173. p. 1074.

Wurtemburg Engine. See *Sipho Wurtemburgicus*.

Y

The *Year* computed by the Turks according to the courſe of the Moon, yet they celebrate the Neuruz, *i. e.* begin each Year on the 21ſt. of March the Vernal æquinox in Conſtantines time, n. 155. p. 440.

Z

Zirknitzerſee deſcribed, n. 191. p. 411.

Zodiaci obliquitas. See Books.

AN
Alphabetical Catalogue
OF THE
BOOKS
Abreviated in the
PHILOSOPHICAL TRANSACTIONS,

From *Numb.* 137. to *Numb.* 206. incluſive.

A

DAvid. *Abercrombij*, M. D. de Variatione ac varietate *Pulsûs* Obſervationes, n. 171. p. 1023. Ejuſdem tuta & Efficax Luis Venerea ſæpe abſque Mercurio ac ſemper abſque Salivatione Mercuriali curandæ Methodus, n. 160. p. 620.

The *Art* of Pruning Fruit-Trees, &c. n. 163. p. 733.

B

Th. *Baker's* Geometrical Key, or the Geometry of all Æquations, &c. n. 157. p. 549.

Jacobus *Barnier* de Spiritu Vini ſine acido, n. 145. p. 111.

Pharmacopœia *Bateana*, n. 206. p. 1000.

Mr. John *Beaumont*'s Conſiderations on Dr. Burnet's Theoria Telluris Sacra, n. 203. p. 888.

Laurentij *Bellini* de Urinis, Pulſibus, &c. Opus, n. 154. p. 425.

Belon's Iteneraries, &c. n. 200. p. 770.

Edwardus *Bernard*, S. T. D. de Menſuris & Ponderibus, &c. n. 177. p. 1242.

Syſtema *Bibliothecæ* Col. Pariſ. Soc. Jeſu, n. 140. p. 1012.

G. *Bidloo*, M. D. Anatomia humani Corporis, n. 178. p. 1309.

Joh. *Bohn* Epiſtola de Alcali & Acidi inſufficientiâ, n. 145. p. 110.

Theoph. *Boneti*, M. D. Medicina Septentrionalis Collatitia, n. 167. p. 867.

Joh. Alph. *Borelli* de Motu Animalium, n. 144. p. 62.

Mr. *Boyle*'s Memoirs for the Natural Hiſtory of *Human Blood*, n. 154. p. 428.

— Experiments and Conſiderations of the Poroſity of Bodies, &c. n. 162. p. 702.

— Eſſays of the great Effects of even languid and unheeded *Motion*, n. 170. p. 986.

— Short Memoirs for the Natural Experimental Hiſtory of Mineral Waters, n. 172. p. 1063.

— Enquiry into the Vulgarly received Notion of *Nature*, &c. n. 181. p. 116.

— *Medicina Hydroſtatica*, n. 192. p. 488.

Benjamini *Brookhuyſen* Oeconomia Animalis, n. 147. p. 194.

Filippo *Buonanni*, Recreatione dell' occhio è della mente nell' Oſſervatione delle Chiocciole, &c. n. 156. p. 507.

Tho. *Burnetij*, S. T. D. Archæologiæ Philoſophicæ, &c. n. 201. p. 796.

C

Gualteri *Charltoni*, M. D. Inquiſitio Phyſica de cauſis Catameniorum & Uteri Rheumatiſmo, n. 171. p. 1020.

Moſes *Charra*'s Royal Pharmacopœia, n. 138. p. 963.

Steph. *Chauvini* Lexicon Reale ſive Theſaurus Philoſoph. n. 199. p. 731.

G. Cole, M. D. Novæ Hypotheſeos ad explicanda febrium intermittentium Symptomata & Typos, excygitatæ Hypotypoſis, n. 197. p. 657.

Confuſius ſinanum Philoſophus, ſive ſcientia ſinenſis latinè expoſita, n. 189. p. 376.

Muſeo *Coſpiano* anneſſo à quello del famoſo Uliſſe Aldrovandi, &c. n. 140. p. 1011.

J. *Craige*, Methodus figurarum lineis rectis & curvis comprehenſarum quadraturas determinandi n. 183. p. 185.

Dr. *Cudworth*'s true intellectual Syſtem of the Univerſe, part. 1. n. 137. p. 936.

R. *Cumberland*, D. D. An Eſſay towards the recovery of the Jewiſh Weights and Meaſures, n. 179. p. 33.

D

D

S. *Dale*, Pharmacologia ſeu Manuductio ad Materiam Medicam, n. 204. p. 925.

Diogenes Laertius Græce & Latine, Edit. Wetſtenij. n.203. p. 886.

Joh. *Dolæi*, M.D. Encyclopedia Medicinæ Theoretico-practicæ, &c. n. 162. p. 704.

Car. *Drelincurtij* Experimenta Anatomica, n. 169. p. 945.

M. *Duncan*, Explication Nouvelle & Mechanique des actions Animales, &c. n. 140. p. 1013.

E

G. *Entij*, M.D. Antidiatribe ſive Animadverſiones in M. Thurſtoni Diatribam de Reſpirationis uſu Primario, n. 142. p. 1072.

Ejuſdem Apologia pro circuitione ſanguinis Edit. ult. n. 173. p. 1105.

Epiſtola ad Reg. Soc. de nuperis *Terræ motibus*, &c. n. 203. p. 893.

Ephemeris ad Annum, 1686. & Longit. Urb. Lond. n. 179. p. 35.

Lazarus *Erckern*, Tranſlated by Sir William *Pettus*, n. 147. p. 189.

Mich. *Etmulleri* Opera omnia, n. 174. p. 1140.

F

Raph. *Fabretti* de Aquis & Aquæductibus Veteris Romæ, Diſſertationes tres, n. 155. p. 466.

Caroli du *Freſne* Gloſſarum ad Scriptores Mediæ & infimæ Latinitatis, n. 140. p. 1013.

G

Johannes *Goedartius* of Inſects Engliſht by Dr. *Liſter*, n. 143. p. 22. n.166. p. 833.

Davidis *Gregorij*, Exercitatio Geometrica de Dimenſione figurarum, n. 163. p. 730.

Nehem. *Grew*, M.D. his Anatomy of Plants, n. 150. p. 303.

H

Edm. *Halley*, Catalogus ſtellarum Auſtralium, &c. n. 141. p. 1032.

Clopton *Havers*, M.D. Oſteologia Nova, n. 194. p. 544.

Helvetiæ Hiſtoria. See Wagnerus.

Louis *Hennepin*, ſa Deſcription de la *Loviſiane* nouvellement decouverte au ſudoueſt de la Nouvelle France, n. 170. p. 980.

Excerpta ex Literis illuſtr. Virorum ad Joh. *Hevelium*, &c. n. 150. p. 308.

Ejuſdem Annus *Climactericus*, n. 175. p. 1162.

Ph. de la Hire Tabularum aſtronomicarum pars prior, n. 191. p. 443.

Th. *Hobeſij* Decameron Phyſiologicum, n. 138. p. 965.

Fred. *Hofmanni* Exercitatio de Cinnabari Antimonij, n. 176. p. 1208.

Rob. *Hook*, M.D. his Lectures and Collections, n. 139. p. 986.

Horti Academici Argentinenſis Catal, See Spoor.

Horti Indici Malabarici pars', 1a. 2a. & 3a. n. 145. p. 100. 4ta. 5ta. & 6ta. n. 198. p. 682. 7ma. 8va. & 9na. n. 200. p. 762.

Chriſtiani *Hugenij* Aſtroſcopia Compendiaria, &c. n. 161. p. 668.

I

F. *Jeſſop* Propoſitiones Hydroſtaticæ ad illuſtrandum *Ariſtarchi* Samij Syſtema deſtinatæ, n. 191. p. 440.

K

Mr. J. *Kuncle*'s Chymical Touchſtone, n. 168. p. 896.

L

Laertius. See Diogenes.

Lectures and Collections. See Hook.

Car. *Leigh*, M. D. Phthiſiologia Lancaſtrienſis, n. 206. p. 1001.

Lemery's Chymiſtry, Edit. 5ta. n. 175. p. 1183.

M. *Liſteri*, M. D. de fontibus Medicatis Angliæ Exercitatio prior, n. 144. p. 59. Exercitatio Altera, n. 158. p. 579. his Edition of Goedartius. See Goedart.

Ejuſdem Hiſtoria Animalium Angliæ. De Araneis Cochleis, &c. n. 139. p. 982.

M

Mallement de Meſſange de la Quadrature du cercle, n. 185. p. 245.

Mr. *Mariotte.* Traittè du Mouvement des eaux, &c. n. 181. p. 119. See Perault.

Joh. *Marij* Caſtorologia, aucta à Jo. *Franco*, n. 177. p. 1249.

Mr. *W. Molineux*'s Sciotericum Teleſcopicum, or a new Contrivance of adapting a Teleſcope to a Sun-dyal, &c. n. 184. p. 213.

Fr. *Moncæi* Diſquiſitio de Magiâ, n. 162. p. 706.

Andr. *Morellij.* Specimen Univerſæ. Rei Nummariæ, n. 166. p. 825.

Obſervations on the *Dublin* Bills of Mortality, n. 143. p. 21.

Ric. *Mortoni*, M. D. Pyretologia, ſeu Exercitationes de morbis Univerſalibus Acutis, n. 199. p. 717.

Joſeph *Moxons* Mechanick Exerciſes, n. 138. p. 967. n. 139. p. 987.

Muſeo Coſpiano. See Coſpiano.

N

Ant. *Nuck*, M. D. de Ductu Salivali Novo, &c. n. 177. p. 1244.

Iſ. *Newtoni* Philoſophiæ naturalis Principia Mathematica, n. 186. p. 291.

P

Dennis *Papin*'s Continuation of the new Digeſter of Bones, n. n. 187. p. 329.

J. N. *Pecklini* de Potu Theæ Dialogus, n. 167. p. 871.

Mr. *Perault* and Mariotts two Letters concerning Viſion, n. 149. p. 265.

Sir Will. *Petty*'s Eſſays in Political Arithmetick, n. 183. p. 152.

Jo. Con. *Peyeri* Merycologia, &c. n. 177. p. 1246.

Mr. Alex. *Pitfield*'s Tranſlation of the Memoirs for a Natural Hiſtory of Animals, n. 189. p. 371.

Rob. *Plott.* L. L. D. De Origine Fontium, &c. n. 167. p. 862. Natural Hiſtory of Staffordſhire, n. 184. p. 207.

Leonardi *Plucknetij* Phytographia, &c. pars 1ma. & 2da. n. 193. p. 528. pars 3a. n. 196. p. 618.

Art of *Pruning* Fruit-Trees, n. 163. p. 733.

Cl. *Ptolomæi* Harmonicorum, Lib. tres. n. 143. p. 20.

R

Jo. *Ray* Hiſtoria Plantarum Tom. 1. n. 186. p. 283.

Wiſdom of *God* manifeſted in the Creation, &c. n. 196. p. 611.

Three Phyſico-Theological Diſcourſes of the *Chaos*, the *Deluge* and *Diſſolution* of the World, n. 196. p. 615.

Ejuſdem *Synopſis Methodica Animalium* Quadrupedum & Serpentini Generis, n. 202. p. 849.

Leenhart *Rauwolff*'s Itenerary, &c. n. 200. p. 768.

Relatione de Ritrovamento dell' *vuova* di Chiocciole, n. 152. p. 356.

Tractè de Moyens rendre les *Riviers* Navigables, n. 203. p. 894.

Willelmi ten *Ryne* diſſertatio de Arthritide acupuncturâ & n. 148. p. 222.

S

Voiage de *Siam* des Peres *Jeſuits*, n. 185. p. 249.

Rob. *Sibbald*, M. D. Scotia illuſtrata, &c. n. 165. p. 795. Phalænologia nova, ſive Obſervationes de rarioribus quibus dam Balænis in Scotiæ Littus nuper ejectis, n. 205. p. 972.

Mr. *Somner*'s Treatiſe of Roman Ports and Forts in Kent, n. 198. p. 688.

Monſi. *Spons* Recherches curienſes, &c. n. 153. p. 386. n. 200. p. 762.

Jo. Fred. *Spoor* Catal. Plantarum Horti Academici Argentinenſis, n. 199. p. 729.

Jo. Chriſtoph. *Sturmij* Collegij experimentalis ſive curioſi pars 2da, n. 175. p. 1184. Ejuſdem *Epiſtola* invitatoria ad Obſervationes Magneticæ Variationis inſtituendas, &c. p. 143. p. 23.

R. *Sydenham*, M. D. Tractatus de Podagrâ & Hydrope, n. 150. p. 309.

T

J. Bapt. *Tavernier*'s Six Voyages through Turky into Perſia, and the Eaſt-Indies, n. 137. p. 942.

De nuperis *Terræ*-motibus Epiſtola ad Reg. Soc. n. 203. p. 893.

Traité des moyens de rendre les *Riviers* Navigables, n. 203. p. 894.

Th. *Trapham*, of the State of Health in *Jamaica*, n. 141. p. 1030.

Triachiaſis admodum rara, &c. n. 170. p. 986.

U

Mr. du *Verney* Traité de l'Organ de l'Ouie, n. 149. p. 259.

Fr. *Vernon*'s Travels, n. 200. p. 768.

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W

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